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FOREWORD

Minerals Yearbook, 1943, records the contribution of the mineral industries during the second year of United States participation in the war. Again it is gratifying to note that despite many difficult conditions that hampered an all-out effort for mineral production—most if not all of them beyond the control of the industry—a new peak of accomplishment has been achieved. For the fifth consecutive year the quantity of minerals produced has increased, and in each of the last 4 years the physical volume of production has exceeded all previous records.

The outlook as of July 1944 appeared to indicate that 1943 probably witnessed the summit of industrial effort in this war and thus possibly was the war year of highest mineral production and consumption. Beginning in 1939, the output of armament and the construction of war-plant and military installations proceeded hand in hand, both at an accelerating rate. By the end of 1942, however, construction had passed its peak, and the downward trend continued in 1943 and into 1944. Industrial output continued to soar throughout 1942 and most of 1943, but by the end of 1943 and during the first half of 1944 it appeared to have reached a relatively stable level.

The foregoing situation focuses attention on many serious problems relating to reconversion of the mineral industries to a peacetime basis and the outlook for the future. Of immediate concern is the disposal of surpluses on hand at the end of the war. Efforts to assure orderly disposal of mineral stocks after the World War of 1914–18 were unsuccessful. Inventories were dumped on the market to such an extent that prices were depressed to distress levels. Production was drastically curtailed, with resultant unemployment and financial loss to the industry. Government and industry are considering methods for avoiding a repetition of this experience. Linked with this problem is the widely endorsed proposal to freeze post-war mineral and metal surpluses for a permanent stock-piling program for national defense. Longer-range consideration should be given to the future of our mineral reserves, which have been depleted at an abnormal rate during the past 4 years, while industry has been restrained from carrying on exploration and prospecting for new deposits, so that developed reserves of some minerals at present are unusually low. This situation needs prompt attention if the United States is to continue to enjoy the same measure of self-sufficiency as in the past.

The economic and statistical services of the Bureau of Mines have been invaluable tools in the planning and administration of the war mineral program. They will be equally valuable in the post-war years, not only in solving reconversion problems but in the orderly and efficient conduct of the mineral industries in the succeeding years of peace. With this in view the Bureau of Mines is already planning its conversion to a peacetime status to be ready to give maximum service when it is needed. Wartime expansion of its facilities and accession of the former Bituminous Coal Division of the United States Department of the Interior will assist the Bureau in achieving this objective.

Again it is a pleasure to acknowledge with appreciation the cooperation of those who contribute so much to the Bureau's work in this field. Thousands of mine, mill, and smelter operators, distributors, consumers, public officials and agencies, and trade journals have made generous contributions of data and advice. Especial mention should be made of the cooperation of State officials who have assisted in collecting mineral statistics within their respective jurisdictions, thus eliminating duplication and improving coverage and accuracy of data. State agents cooperating in the 1943 canvass were: Stewart J. Lloyd, assistant State geologist, University, Ala.; Herman Gunter, State geologist, Tallahassee, Fla.; Garland Peyton, director, division of mines, mining, and geology, department of natural resources, Atlanta, Ga.; M. M. Leighton, chief, and Walter H. Voskuil, mineral economist, State geological survey division, Urbana, Ill.; A. C. Trowbridge, director, Iowa Geological Survey, Iowa City, Iowa; John C. Frye, acting director, State Geological Survey of Kansas, Lawrence, Kans.; J. T. Singewald, Jr., director, department of geology, mines and water resources, board of natural resources, Baltimore, Md.; R. A. Smith, State geologist, Lansing, Mich.; Edward L. Clark, State geologist, Rolla, Mo.; Edward Ellingwood, chairman, New Hampshire mineral resources committee, Concord, N. H.; Meredith E. Johnson, State geologist, Trenton, N. J.; C. A. Hartnagel, State geologist, New York State Museum, Albany, N. Y.; Jasper L. Stuckey, State geologist, Raleigh, N. C.; Robert H. Dott, director, Oklahoma Geological Survey, Norman, Okla.; E. P. Rothrock, State geologist, Vermillion, S. Dak.; E. H. Sellards, director, bureau of economic geology, Austin, Tex.; Arthur Bevan, State geologist, and Linwood H. Warwick, chief clerk, Virginia Geological Survey, Charlottesville, Va.; Sheldon L. Glover, supervisior, division of mines and mining, department of conservation and development, Olympia, Wash.; Paul H. Price, State geologist, Morgantown, W. Va.; and E. F. Bean, State geologist, Madison, Wis. In addition, B. D. Stewart, department of mines, Juneau, Alaska, and Walter W. Bradley, State mineralogist, San Francisco, Calif., assisted in the compilation of statistics for Alaska and California, respectively.

R. R. SAYERS,
Director.

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INTRODUCTION

Although Minerals Yearbook, 1943, follows essentially the make-up of earlier volumes, certain changes have been introduced to supply more effectively the needs of the mineral industries for up-to-date statistics.

Chief of these is making current for the first time since 1931 the detailed mineral production by States in the chapter on the Statistical Summary of Mineral Production. Iron ore constitutes a separate chapter, with another on pig iron, ferro-alloys, and steel, whereas formerly the four commodities were grouped under one heading. A number of chapters have been expanded to give certain minerals the proper place in a changing wartime economy, but others necessarily have been reduced, and the chapter on Wyoming has been combined with that on South Dakota. An added feature in the present volume is a section covering the post-war outlook on all but a few of the minerals treated. A number of new charts have been introduced, and many of the charts that appeared in earlier volumes have been redrafted to improve their appearance and usefulness.

Censorship regulations still require that information on strategic and critical minerals, as well as most foreign trade data, be held confidential; consequently Minerals Yearbook, 1943, will be impounded, as was the 1942 edition, and the volume will be issued only to authorized Government and State agencies that need the information it contains. However, regulations have been relaxed to some extent so that the 15 State chapters, which were confidential in the 1942 volume, are available for public distribution. In addition 9 other chapters, from which foreign trade figures have been eliminated because they are of slight significance, will be released.

Acknowledgments.—Collection of the vast quantity of statistical data for Minerals Yearbook is accomplished entirely through the good will and voluntary cooperation of those interested in the welfare of the mineral industries. War conditions have imposed many handicaps on these groups and individuals, but the response has been most generous, and the Bureau wishes to express its deep appreciation of the time and effort given by the multitude of operators, distributors, consumers, public officials, trade associations, and others who have kindly furnished the basic data for this volume.

The data on exports and imports in Minerals Yearbook were obtained through cooperation of the United States Department of Commerce.

The usefulness of this volume is credited largely to the splendid service given by the authors of the chapters and the many members of the Bureau's staff who assisted in the editing and arrangement of the Yearbook material. Those deserving especial mention for assistance in maintaining the high statistical accuracy of the volume are: Martha B. Clark, and Marian E. Meyer, of the Economics and Statistics Branch, for preparing the statistical summary of mineral production and for supervising the presentation of statistical data; Mabel E. Winslow, of the Office of Minerals Reports, for careful editorial work and counsel; Louis F. Perry of the Office of Minerals Reports, and Adelaide B. Palmer, of the Economics and Statistics Branch, for their aid in preparing the charts; and the many members of the Economics and Statistics Branch who helped the authors in the preparation of their manuscripts.

C. E. NEEDHAM.

PART I. GENERAL SUMMARY

REVIEW OF THE MINERAL INDUSTRIES IN 1943[1]

By E. W. PEHRSON

SUMMARY OUTLINE

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INTRODUCTION

The mineral industry again broke all previous records for total production in 1943 as the value of output soared to $8,056,000,000. The new peak was 6 percent above the previous high of $7,575,700,000 in 1942 and 15 percent above the pre-war record of $6,981,340,000 established in 1920. The rise in value for 1943 resulted from a 2.3-percent advance in the physical volume of production, as measured by Federal Reserve Board indexes, and a 4.5-percent increase in the unit sales realizations of mineral producers.

As in 1942, the mining industry operated under severe handicaps. Scarcity of manpower was the chief hindrance during 1943, but other factors—such as transportation controls, shortage of equipment, increasing costs, shut-down orders for gold and silver mines, and lack of adequate price incentive—also were contributing causes.

Although strict conservation and control measures were continued on a large scale in 1943, many minerals were used in greater quantities than ever before. There were some sharp recessions, however, particularly in the demand for building materials. The net result of these divergent trends was an over-all gain in consumption, which reached a new peak. Heavy imports continued during the year with relative ease as success was achieved in minimizing the effects of enemy submarines. However, shipping space was far from plentiful, as the movement of troops and munitions overseas required a very large proportion of available bottoms. Domestic production and imports again were more than adequate to meet military and essential civilian needs, and there was a small net gain in the Nation's stocks of mineral raw materials.

Price movements in 1943 were generally upward, but except for fuels the gains were inconsequential. An estimated average 4.5-percent gain in price realizations of mineral producers, resulting very largely from increases in coal, petroleum, and petroleum products, compared favorably with the 4.4-percent rise in the general price level as revealed by Bureau of Labor Statistics indexes of wholesale prices.

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[1] In this report the term "billion" is equivalent to 1,000,000,000.

However, the comparison is decidedly less favorable with 1940. The average unit return on minerals, including premium payments, as estimated by the Bureau of Mines, has increased only 19.9 percent from 1940 to 1943, whereas wholesale prices have advanced 31.2 percent.

PRODUCTION

Value of mineral output.—The value of minerals produced in the United States in 1943 exceeded 8 billion dollars for the first time and for the second consecutive year established a new peak.

Fuels are the principal contributors to the value of mineral production, having supplied $4,589,000,000 or 57 percent of the total in 1943. Metals ranked second, with $2,493,000,000 or 31 percent of the total, and nonmetals (other than fuels) third, with $974,000,000 or 12 percent. The growth in value of these branches of the mineral industries since 1880 is shown in figure 1.

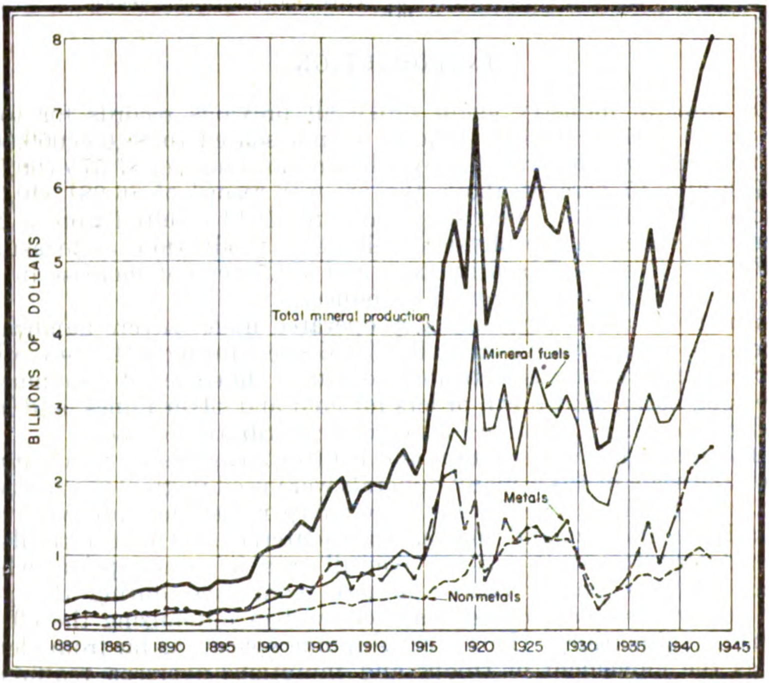

FIGURE 1.—Trends in value of mineral production in the United States, 1880–1943.

All major divisions of mineral production increased in value of output in 1943 except nonmetals (other than fuels). The 12-percent decline in the value of nonmetallic minerals (other than fuels) showed the reduced demand for building materials that resulted chiefly from the sharp drop in military construction. The value of metals was 5 percent above that of 1942; this increase resulted from a rise in both prices and physical volume of production. The value of fuels advanced 12 percent. Oil and gas wells contributed products valued at $2, 713,-000,000 in 1943—34 percent of the total mineral value and an increase of 10 percent over 1942. Hard- and soft-coal production was valued at $1,876,000,000, or 23 percent of the value of all mineral products and 14 percent more than the value of coal produced in 1942.

The 6-percent increase in mineral production in 1943 compares with a 22-percent advance in gross farm income as reported by the United States Department of Agriculture ($18,628,000,000 in 1942 and $22,675,000,000 in 1943, including Government payments) and a 23-percent rise in the gross national product [2] (152.1 billion in 1942 and 186.5 billion dollars in 1943). National income increased from $121,568,000,000 in 1942 to $147,927,000,000 in 1943 (22 percent), according to the United States Department of Commerce. Since 1939 the value of mineral production has gained only 64 percent, whereas gross farm income rose 129 percent, gross national product 110 percent, and national income 109 percent.

Failure of the mineral industry to keep pace with other elements of the national economy may be ascribed to several factors. Some mineral commodities, such as gold, silver, and certain building materials, have been adversely affected by war conditions so that their production has not profited from the general economic improvement. Government controls have restrained civilian and in many instances military consumption of most of the other minerals, and these restraints have been reflected in mining activity. Shortage of manpower, exhaustion or lack of resources, inadequate production capacity, and scarcity of mining equipment have prevented the domestic industry from meeting all war needs of some minerals, and the deficiencies have been made up by abnormally large importations. Copper, lead, and zinc are typical examples of this development. All these factors have retarded the advance in physical volume of mineral production; and in addition, as will be shown later, the rise in the value of mineral production has been impeded by prices that consistently have been substantially below the general level.

Trends in physical volume of production.—Figure 2 compares the physical volume of mineral production during the last 44 years with industrial and agricultural production and with population growth, each expressed in terms of an index based upon yearly averages for 1935–39.[3]

The long-time trends of production during this 44-year period have been steadily upward, although year-to-year and cyclical fluctuations have been prominent. Except for the last few years, the production of minerals—the essential raw materials for industry—has been closely correlated with the trend of industrial production, experiencing the same ups and downs, whereas agricultural production has exhibited more moderate fluctuations and a growth line approximating the trend of population increase.

Because production of coal for domestic use and petroleum for automobile fuel, which has a pronounced effect on the trend of mineral output, does not respond proportionately to increases in the rate of manufacturing activity and is more stable, the index of industrial production tends to exceed that of mineral production in periods of prosperity and to fall below during depressions. This characteristic explains in part the wide gaps between the two indexes from 1941 to 1943. Another contributing factor is the extensive use of imported mineral raw materials in these years, which is reflected in the industrial index but not in the mineral index. It should also be noted that the Federal Reserve Board index of mineral production does not include certain mineral products, such as aluminum and magnesium, while the greatly expanded war production of aircraft in which these metals are used is included in the index of industrial production.

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[2] The U. S. Department of Commerce defines gross national product as the total value of currently produced goods and services flowing to Government, to businesses for gross capital formations, and to consumers. War expenditures comprised 44 percent of the total in 1943 and 33 percent in 1942.

[3] The following indexes have been used—volume of farm production, U. S. Department of Agriculture; mineral production, 1900–18, from Warren Persons' Forecasting Business Cycles; mineral production of 1919–43 and industrial production, Federal Reserve Board; total population of the United States, Bureau of the Census.

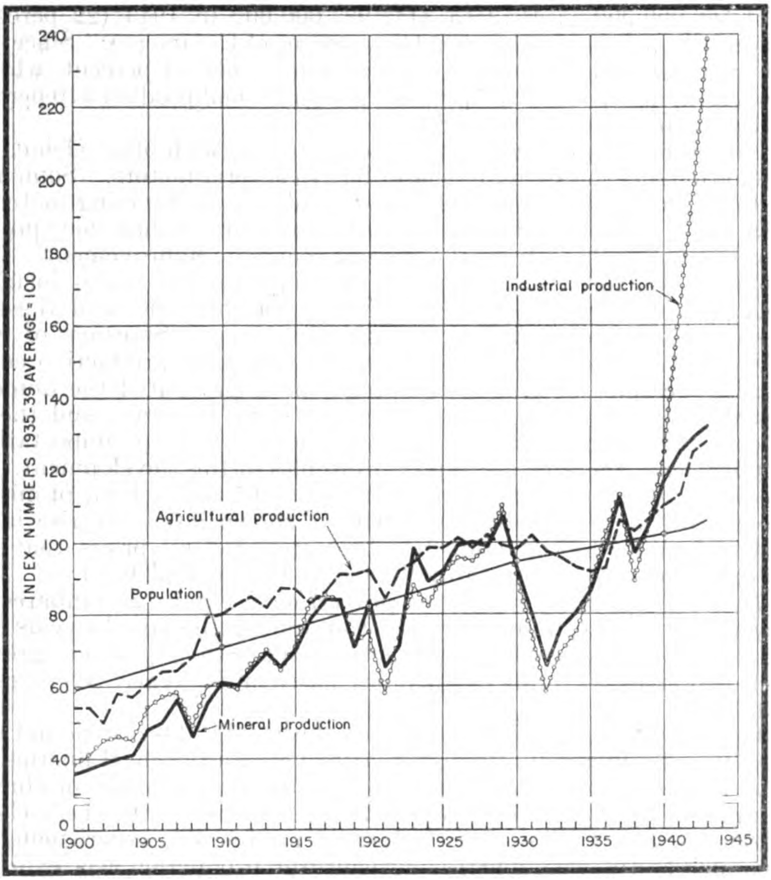

FIGURE 2.—Comparison of growth of physical volume of mineral production with that of agricultural and industrial production and population, 1900–43.

The production of many mineral commodities established new records in 1943, although the achievement in this regard is less spectacular than that of 1942. The light metals again made outstanding advances. Magnesium output almost quadrupled; bauxite production increased 140 percent and that of aluminum 77 percent. The quantity of copper mined exceeded the previous peak of 1942 by only 1 percent, whereas the production of lead and zinc decreased in 1943. Sharp declines also were noted in gold and silver mining. Mercury production advanced again, but the 1943 output was much less than the record established in 1877. Production of titanium minerals, chiefly ilmenite, more than doubled and reached a new high. Domestic output of the ferro-alloying metals—tungsten, molybdenum, vanadium, and chromium—reached new heights in 1942 by substantial margins. Manganese-ore production increased over 1942 but was below the 1918 high. Iron-ore output was 6 percent under the record established in 1942. Production of all the major fuels gained in 1943, bituminous coal, petroleum, natural gas, and natural gasoline, and liquefied petroleum gases reaching new peaks. Anthracite output was only slightly above 1942 and considerably below previous highs. Reduced building activity in 1943 caused a slump in the production of cement, clays, gypsum, sand and gravel, and stone. Production of feldspar and sulfur also declined, but several other nonmetallic minerals (including asphalt, fluorspar, lime, phosphate rock, potash, pyrite, and salt) established new records.

STOCKS

Inventory-control measures continued in effect throughout 1943, but in the second half of the year there was a decided trend toward easing the restrictions that had been imposed earlier in the war. As enemy submarine attacks became less menacing, emphasis on the building up of stocks of materials from overseas sources as a safety measure was relaxed, so that use of ships in moving troops and war supplies could be intensified. On the other hand, consumption schedules for some commodities were scaled down without equal reductions in supply, and inventories rose accordingly. The net result of these developments was a general gain in stocks. For many minerals, a decline in industry stocks was more than offset by increases in Government stocks. This group included antimony, asbestos, beryllium, chromite, copper, Madagascar flake graphite, block mica, platinum, tungsten, and zinc. There were increases in both industry and Government stocks of aluminum, bauxite, cryolite, industrial diamonds, fluorspar, magnesium, mercury, molybdenum, nickel, quartz crystals, lithium minerals, and ground talc. The net total of industry and Government stocks declined for Ceylon lump graphite, Indian kyanite, lead, manganese ore, mica splittings, tin, and vanadium. Industry stocks of iron ore, iron and steel scrap, bituminous coal, anthracite, and ilmenite dropped sharply in 1943, whereas those of pig iron, cement, and magnesite were larger at the end of the year than at the beginning; the Government was not stock-piling any of these commodities. A small increase in industry stocks of crude petroleum was more than offset by a decline in refined products, but the net decline in these inventories probably was less than the gain in Government stocks, indicating a probable net gain in total stocks on hand in the United States.

The large stocks of raw materials on hand, the tremendous increase in the inventories of metals and minerals in process and in finished munitions, and the stocks of battlefield scrap rapidly accumulating at home and abroad—all of which would weigh heavily on post war markets—prompted considerable agitation for a permanent stock-piling program. Developments in this field are discussed under Government Stock-Piling Activities in this summary.

CONSUMPTION

Consumption of minerals continued its upward trend in 1943, but the diminishing rate of increase during the latter half indicated that the United States was reaching its full industrial stride for successful prosecution of the war. Many new records in mineral consumption were made during the year, although several commodities were used less in 1943 than in 1942; on the average, there was a moderate gain. Even larger quantities could have been consumed had it not been for manpower shortages, which proved to be the principal restraining influence in 1943. Manpower rather than available supplies or markets will likewise dominate the situation in 1944 when no substantial increase in mineral consumption is anticipated and a moderate decline may be expected if the war in Europe is concluded at an early date.

The magnitude of the industrial contribution to this war is revealed by the Federal Reserve Board indexes of industrial activity. The index for total production (1935–39 average=100) rose from 89 in 1938 to 238 in 1943. The adjusted monthly index reached a peak of 247 in October and November and then receded to 242 in March 1944. The rise in manufacture of durable goods, in which class most of the munitions fall, was more spectacular, the index having advanced from 78 in 1938 to 360 in 1943, and this rise was accentuated by a shift from the production of civilian goods to the manufacture of munitions. The production index for transportation equipment, which reflects the expanded output of airplanes, automobiles, ships, railroad cars, and locomotives, rose from less than 100 early in 1939 to a peak of 786 in November 1943. There has also been a significant though less substantial increase in the production of nondurable goods, the index having advanced from 95 in 1938 to 176 in 1943.

The war program has required metals, fuels, and industrial minerals in unprecedented quantities, and many new records were established in 1943. Consumption of iron ore, iron and steel scrap, and virtually all the alloying metals that are used in steel making rose to new heights; the use of molybdenum, however, declined. Most of the nonferrous metals also were used in record quantities, the light metals showing the largest increases over 1942 and pre-war rates. Zinc consumption was higher than in 1942 but below the peak of 1941, and the use of tin again was reduced by rigid conservation measures. All the fuels except anthracite were burned in larger quantities than ever before, and many of the other major industrial nonmetallic minerals, including asphalt, fluorspar, lime, sulfur, and salt, advanced to new consumption peaks. New records for the fertilizer and soil-conditioning minerals—phosphate rock, potash, and sulfur—showed the buying power of the 23-percent rise in cash farm income.

In contrast to the continued rise in industrial production, construction activity fell abruptly in 1943. According to the United States Department of Commerce, the total value of all new construction put in place in continental United States during the year was $7,868,000,000, a 55-percent decline from $17,379,000,000 in 1942; the value in 1938 was $5,254,000,000. All major branches of construction—residential, industrial, military and naval, and public utility—were curtailed in 1943. As a consequence, consumption of building materials of mineral origin was affected adversely.

PRICES

The weighted composite index of price change in 1943 for 24 mineral commodities that represent 96 percent of the total value of mineral production during the year indicates a 4.5-percent increase over the average unit realization by producers in 1942. Comparison of the 1943 index with that for 1940, the base year, indicates a total rise of 19.9 percent, of which the larger part was in 1941 when the average returns to producers gained 9.3 percent over 1940. The rate of increase lessened appreciably in 1942 after price ceilings were fixed by Government regulation, and the indicated rise in unit realization for the year was 4.9 percent over 1941. In 1943 the average unit return increased over 1942 in each mineral group; however, the gain in the index for the 5 mineral fuels was largest—5.8 percent. For the metals group (9 commodities), the increase was 2.5 percent, and the index for the nonmetals group (10 commodities) indicated a 2.9-percent gain over the unit realization in 1942. The indicated general rise in the 1943 average unit returns resulted from a variety of factors, the principal ones being subsidies paid to producers of high-cost copper, lead, and zinc and regional and local increases permitted in ceiling prices. Another factor of importance in the nonmetals group was the constriction, either by natural economic forces or by Government regulation, of market areas of products sold on a delivered basis, which resulted in less freight absorption and consequently higher average returns to the producer.

The indicated increase in prices received by mineral producers in 1943 was virtually at the same rate as the rise in wholesale prices of all commodities. According to the Bureau of Labor Statistics, the wholesale price index (1926=100) of all commodities advanced from 98.8 in 1942 to 103.1 in 1943, a 4.4-percent gain. However, during 1941 and 1942 the average unit realization to mineral producers did not increase nearly as rapidly as wholesale prices, and in 1943 the average unit return on minerals was only 19.9 percent above 1940, whereas the wholesale price index was 31.2 percent higher than in 1940. Wholesale prices for fuels increased appreciably in 1943; the indexes for anthracite and bituminous coal each rose nearly 6 percent and for petroleum and its products 4.5 percent over 1942. The strict regulation of prices was illustrated by the general index for metals and metal products, which was unchanged from 1942 at 103.8. Similarly, prices of nearly all component raw materials and fabricated products making up the iron and steel group were unchanged from 1942; the most important exception was ferromanganese, for which the index showed a gain of nearly 4 percent. The wholesale price level of the nonferrous metals group, which includes some finished products and excludes subsidy payments for copper, lead, and zinc, advanced only slightly over 1942, owing principally to increases in antimony and silver prices. Mercury was the only component of this group for which the index declined. In the building-material group, the general wholesale price index increased from 110.2 in 1942 to 111.4 in 1943. However, the prices of most mineral building materials changed little from 1942; and some, such as cement, plaster, and gypsum lath, declined. Brick and tile and paint prices were slightly higher than in 1942. The general index for chemicals and allied products, which includes numerous mineral commodities, increased from 97.1 in 1942 to 100.3 in 1943, a gain of 3.3 percent. Wholesale prices of fertilizer materials as a group gained 1.7 percent over 1942, although the indexes for phosphate rock, potash salts, and sodium nitrate declined appreciably from 1942.

EMPLOYMENT

The severe labor-supply problems that all mining activities had experienced in 1941 and 1942 were continued in 1943 but became less critical as war demands were lowered for virtually all major minerals except coal. Employment continued to decrease because of migration from the mining centers, but the loss of manpower was largely counterbalanced by a general increase in man-hours worked. The number of men employed in the mineral industries in 1943, according to preliminary figures, was 732,600—a 9-percent recession from 1942; man-hours of employment declined less than 0.5 percent. The reasons for manpower losses were largely the same as in previous years, and only strenuous efforts by Government, industry, and labor prevented the situation from becoming critical during 1943.

The major Government employment efforts during 1943 were directed toward replacing lost manpower, preserving vital occupational skills from Selective Service withdrawals, and increasing the utilization of the labor still employed in mining. For virtually the entire year recruitment of labor for metal mining received highest priority from the United States Employment Service in the Western States. Considerable progress was made as a result of this sustained recruiting program, but by midyear it was obvious that the results were insufficient. It was necessary once more for the Army to release soldiers to the mines to make up the deficit. In August and September 1943 the 9th Service Command of the United States Army released 4,500 soldiers to copper, zinc, and molybdenum mines. These soldiers did not have the occupational skills most in demand, but their release aided considerably in meeting the general labor-supply requirements of the mines. Changes in war demands for these metals and the Army's urgent need for young, able-bodied soldiers resulted in the recall of all furloughed soldiers in the age bracket of 18 to 25 during March to June 1944.

Another important step taken by the Government in June 1943 to overcome metal-mining labor-supply problems was the setting up of a Minerals Classification List by the War Production Board for the use of the United States Employment Service in directing referrals and transferring labor from one mine to another. This list set up a system of priorities wherein the various mines were rated by productivity per man.

> Class I operations, listed within metals or minerals, are those operations which are considered at the time of issuance of each classification list to be the most critical to the war economy and are the operations upon which first efforts in recruitment should be concentrated.
>
> Class II operations, listed within metals or minerals, are essential operations to which referrals may be made of applicants for employment who do not accept employment in class I operations whether for reasons of working conditions, location of domicile, climatic conditions, or other reasons. Certificates of availability are to be denied to employees of these operations, except in unusual cases wherein the transfer desired is to a class I operation.

Class III operations, not listed, are all operations not classified as 1, 2, or 4. Although no direct recruitment of employees from these operations is to be allowed, cerificates of availability are to be granted to all voluntary withdrawals, provided the applicant is willing to accept referral to class 1 or class 2 establishments.

Class IV operations, listed as to operations, are operations whose contribution to the war effort is minor in proportion to the manpower and material utilized. Recruitment campaigns among workers at operations in this class is encouraged when such recruitment are for operations in class 1 and class 2.

In general, it is desired that no certificates of availability be granted to workers in any mines, mills, smelters, or refineries (class 1, 2, 3, or 4) except for work at other mines, mills, smelters, or refineries, and except for such transfers as are mandatory under the rulings of the stabilization order. It is urged that every measure be taken to tighten the issuance of certificates of availability to workers who plan to leave the mining industry.

The War Manpower Commission has reported that the use of this list has resulted in increased employment in all class I and II mines, whereas employment in the low-productivity mines of classes III and IV declined.

The employment-stabilization program for the nonferrous metal-mining industry of the 12 Western States, which was set up by the War Manpower Commission in September 1942, was continued throughout most of 1943. In January 1943, Government, management, and labor representatives of the nonferrous mining industry conferred in Denver; at that time a complete review of experience resulted in agreement to continue the program. However, inforcement problems and the great geographical area covered by the industry-stabilization program resulted in the industry type of control being replaced by an area-stabilization program on August 16, 1943 (War Manpower Commission Regulation 7). Reports are in general agreement that turn-over and outmigration were reduced by the stabilization orders, but at best these were only a part of the over-all problem.

Selective Service policies on mining labor were revised during 1943 and resulted in decreased withdrawals for military service. Local boards were instructed to give all mining workers the most serious consideration for occupational deferment, regardless of the degree of skill and whether or not a formal request for deferment of the worker had been made. Selective Service also authorized the transfer of appeals to the area in which the worker was employed rather than in the area of original registration.

Early in 1943 the War Manpower Commission ordered a minimum workweek of 48 hours established for all metal-mining workers in the Western States. Virtually all large operations had already established a 48-hour week, and this order merely made the practice uniform throughout the industry.

Wage increases were prominent only in fluorspar and coal mining during 1943. Loss of workers from fluorspar mines is said to have been halted as a result of a wage-rate increase effected in July. In coal mining the wage increases followed some of the most serious strikes in the Nation's history. With war demands for coal increased to high levels, the industry faced wage controversies which seriously threatened the entire war program. Wage rates were not raised, but the "take-home" was increased by the award of pay for the time spent in traveling to and from the working face (portal to portal) and the raising of the workweek to 48 hours.

By the end of 1943, the mining industry's employment problems, save in coal mining, were largely those of maintenance of production at established levels. In coal mining the problem was still complicated by rising demand and continued, although lowered, losses of manpower through retirements, accidents, and other normal causes, plus the difficulty of training new workers, especially in the more highly mechanized mines.

SAFETY

The combined safety record of the mineral industries of the United States, considered from the standpoint of workers exposed to occupational hazards, was favorable. Although the volume of labor performed was greater (except for 1942) than in any previous year since 1931, when records of man-hours worked first became available, and although the pressure for more war production continued, the accident frequency in relation to the number of man-hours worked did not rise in 1943; on the contrary, the rate was slightly more favorable than in 1942. According to preliminary, figures, the fatality rate for the mineral industries was 1.18 per million man-hours worked, which compares favorably with 1.21 for 1942 and 1.26 a decade ago. The 1943 nonfatal-injury rate was 59.11 per million man-hours, a substantial reduction from 61.24 in 1942 and 73.48 in 1933.

According to present reports, accidents during 1943 resulted in injury to 92,740 employees—about 3,600 fewer injuries or 4 percent less than in 1942—although the number of man-hours of exposure to occupational hazards decreased less than 1 percent. Fatalities declined 3 percent—from 1,861 in 1942 to 1,813 in 1943. Seven major disasters (disasters causing 5 or more deaths) in which 161 men lost their lives occurred in 1943, all in bituminous-coal mines. Six were due to explosions of gas or dust, and one resulted from a mine fire. In 1942, 132 lives were lost in major disasters.

Chief among the mining industries that reported more favorable accident rates in 1943 than in 1942 were bituminous-coal mining and Pennsylvania anthracite mining. Special significance attaches to a reduction in the rates for these two groups, because together they include approximately two-thirds of the total number of employees in all mineral industries combined. Metal mines, considered as a group, made progress in accident prevention in 1943. Several members of the group, however, such as copper mines, lead-zinc mines in the Mississippi Valley States where production was being pushed, and gold-silver mines (operating on reduced employment), reported higher rates. Special credit is due the group of mines that produced such war-needed metals as tungsten, manganese, mercury, and other so-called minor metals for effecting a large reduction in accidents. The stone-quarrying industry operated with an accident-frequency rate that was slightly higher than in 1942 but lower and more favorable than that in 1941. Beehive-coke ovens reported an accident rate that was virtually the same as in 1942; byproducts oven continued to operate with especially low rates, although a fraction higher than in 1942. Mills and concentrating plants reported a reduction in accident frequency. The rate for smelters increased slightly.

A special study, begun 2 years ago, of accidents reported by companies engaged in the production of petroleum was continued through 1943. The study, as far as it had progressed at this writing, revealed an accident-frequency rate of 20.32 per million man-hours worked. This rate was not as favorable as that of 1942, which was 18.27 as shown by final figures, but it was almost the same as the rate finally reported for 1941—20.40.

GOVERNMENT STOCK-PILING ACTIVITIES

Recent experience in the procurement of mineral raw materials for war production and the desire to avoid the deflationary effects on post-war markets that would result from dumping surplus mineral stocks at the close of the war have stimulated considerable interest in a national stock-piling program. On June 3, 1943, a bill (S.1160) was introduced in the Senate of the United States:

> To stimulate production of strategic and critical minerals for the present war effort and to assure an adequate supply of such minerals for any future emergency by continuance, intact, in the post-war period of all stock piles surviving the present war and by necessary augmentation thereof primarily from domestic sources, and for other purposes.

After public hearings on the bill a revised version, S.1582, was introduced on December 8, 1943. Wide divergence of opinion developed on many features of these bills, but there was substantial support for two of the objectives of the proposed legislation—the creation of stock piles for national defense and the freezing of stocks at the end of the war to provide the nucleus for permanent stock piles and to prevent undue dislocation of post-war markets. Several other bills along similar lines subsequently were introduced in Congress, and the executive departments initiated a study of the problem with a view to suggesting a program that would reflect the views of the Executive Branch. As of July 1, 1944, however, no positive action had been taken by either branch of the Government. Interest in permanent stock-piling legislation appeared to have waned temporarily because of the pressure for legislation to facilitate reconversion of industry from a wartime to a peacetime basis.

From the viewpoint of the mineral industries, the freezing of surplus stocks of minerals and metals (including scrap) at the close of the war should be a prerequisite of any program designed to cushion the effects of sudden termination of war production. This is supported by experience following the last war, when the inadequately controlled liquidation of metal and scrap stocks brought on a deflation of the metal markets which resulted in widespread unemployment due to forced curtailment of production from 1920 to 1922. On the other hand, consumers point out that there should be no restraints on raw-material supplies if industry is to meet the tremendous demand for goods that many anticipate will follow the termination of World War II. Freezing of war stocks might retard the production of goods for civilian consumption or induce inflationary tendencies in the raw-material fields that would be inimical to the maintenance of post-war stability. Both viewpoints emphasize the necessity for providing sound controls on the distribution of war-end surpluses in any reconversion program that may be adopted.

During the war the Government has fostered a gigantic purchasing and stock-piling program for strategic and critical materials. This activity was inaugurated in 1939 following the passage of the Strategic Materials Act, Public 117, 76th Congress, which was approved on June 7, 1939. The law authorized the appropriation of

$100,000,000 to be used over a period of 4 years for the purchase and stock-piling of strategic and critical materials; of that sum, Congress actually appropriated only $70,000,000. Collapse of the Allied armies in Europe in May 1940 resulted in a tremendous increase in the defense program of the United States and also focused attention on the need for greatly expanding the procurement of raw materials. On June 25, 1940, Public 664, 76th Congress, was approved, authorizing the Reconstruction Finance Corporation to engage in extensive national defense activities, including the purchase and carrying of strategic and critical materials, as defined by the President. A very large part of all raw material acquired by the Government since 1940 has been procured under the authority granted by this act. As of September 1943 the list of minerals and mineral products that had been declared strategic or critical by the President and the Army and Navy Munitions Board was as follows:

Commodity [1]	Designation [2]	Designated by	Date
Aluminum	C	A and NMB	Jan. 30, 1940
Aluminum bar and rods	S and C*	President	Dec. 17, 1942
Aluminum rivets	S and C*	do	Apr. 15, 1942
Antimony (and ores)	S	A and NMB	Jan. 30, 1940
Arsenic	S and C*	President	July 3, 1941
Asbestos	C	A and NMB	Jan. 30, 1940
Bauxite	C*	do	Mar. 25, 1941
Beryl ores	S and C*	President	Apr. 25, 1941
Bismuth (and ores)	S and C*	do	Do.
Cadmium (and ores)	S and C*	do	Do.
Calcined coke	S and C*	do	Nov. 6, 1942
Chromium (and ores)	S and C*	do	Jan. 30, 1940
Coal	S	do	May 22, 1942
Cobalt (and ores)	S and C*	A and NMB	Apr. 25, 1941
Columbite	S and C*	President	Apr. 2, 1942
Copper (and ores)	C*	A and NMB	Dec. 11, 1940
Corundum ore	S and C*	President	Dec. 5, 1941
Cryolite	S and C*	do	July 3, 1941
Diamonds, industrial (and bort and diamond dies).	S#	A and NMB	June 21, 1940
English china clay	S and C*	President	Sept. 3, 1942
Fluorspar	S and C*	do	Apr. 17, 1941
Gasoline, aviation (100 octane)	C*	A and NMB	Aug. 27, 1940
Glass, optical	C	do	Jan. 30, 1940
Graphite	C	do	Do.
Indium	S and C*	President	Oct. 24, 1941
Iodine	C	A and NMB	Jan. 30 1940
Iridium (and ores)	C*	do	May 28, 1941
Iron ore	S and C*	President	Oct. 3, 1941
Iron and steel	S and C*	do	June 4, 1943
Jewel bearings	C*	A and NMB	Aug. 28, 1941
Kyanite	S and C*	President	Jan. 16, 1942
Lead (and ores)	S and C*	do	Apr. 17, 1941
Lithium minerals	S and C*	do	Oct. 28, 1942
Magnesite	S and C*	do	Feb. 6, 1942
Magnesium	S and C*	do	May 20, 1941
Manganese, ferrograde (and ores)	S	A and NMB	Jan. 30, 1940
Mercury (and ores)	S	do	Do.
Mica	S	do	Do.
Molybdenum (and ores)	S and C*	President	May 20, 1941
Monazite sand	S and C*	do	Sept. 5, 1941
Nickel (and ores)	S	A and NMB	Jan. 30, 1940
Nitrogen compounds (including ammonia, nitric acid, and Chilean nitrates).	C*	do	Dec. 4, 1940
Osmium	S and C*	President	Oct. 24, 1941
Palladium	S and C*	do	Do.
Petroleum and petroleum products	S and C*	do	July 9, 1943
Petroleum coke	S andC*	do	Nov. 6, 1942
Platinum (and platinum group) and ores	C	A and NMB	Jan. 30, 1940
Quartz crystal	S	do	Do.
Refractory brick	S and C*	President	July 10, 1943
Rhodium	S and C*	do	Oct. 24, 1941
Ruthenium	S and C*	do	Do.
Rutile	S and C*	do	Apr. 25, 1941
Scrap iron and steel	S and C*	do	Sept. 5, 1941
Sillimanite	S and C*	do	Jan. 16, 1942
Steatite talc	S and C*	do	Apr. 2, 1942

Footnotes at end of table.

Commodity[1]	Designation[2]	Designated by	Date
Strontium minerals	S and C*	President	Sept. 3, 1942
Tantalite	S and C*	do	Apr. 2, 1942
Tin (and ores)	S	A and NMB	Jan. 30, 1940
Topaz ore	S and C*	President	Apr. 13, 1943
Tungsten (and ores)	S	A and NMB	Jan. 30, 1940
Vanadium (and ores)	C	do	Do.
Zinc (and ores and zinc concentrates)	C*	do	Mar. 11, 1941
Zirconium (and ores)	S and C*	President	Apr. 25, 1941

[1] Materials in parentheses are included by implication.
[2] S—Strategic; C—Critical; S and C—Strategic and critical.

*Designated for purposes of procurement under 15 USC 606b (Public 664).
#Designated for purposes of procurement under 50 USC 98 (Public 117).

Since 1940 the strategic and critical material procurement program of the Government has been designed to build up substantial stock piles, in addition to supplying current needs, to provide a margin of safety for possible extreme emergencies. For some commodities, supplies of which were or could be threatened by enemy action, stock-pile goals originally were set as high as a 3-year supply. As the military outlook improved, stock-pile objectives were reduced, and during 1943 most plans called for the accumulation of not over a year's requirements. Early in 1944 the War Production Board established a formula for further reducing its stock-pile recommendations. Except where special considerations were involved, the formula calls for stock piles equal to 3 months of peak wartime consumption, or 1 year's war consumption minus the amount produced in North America, whichever is greater. The reserve stocks so determined are in addition to normal working inventories required by industry.

On March 6, 1944, the Army and Navy Munitions Board approved the following revised definition of strategic and critical materials:

> Strategic and critical materials are those materials required for essential uses in a war emergency, the procurement of which in adequate quantities, quality, and time is sufficiently uncertain for any reason to require prior provision for the supply thereof.

Formerly strategic and critical materials had been defined separately as follows:

> Strategic materials are those essential to national defense, for the supply of which in war dependence must be placed in whole, or in substantial part, on sources outside the continental limits of the United States; and for which strict conservation and distribution control measures will be necessary.
>
> Critical materials are those essential to national defense, the procurement problems of which in war would be less difficult than those of strategic materials either because they have a lesser degree of essentiality or are obtainable in more adequate quantities from domestic sources; and for which some degree of conservation and distribution control will be necessary.

The new simplified definition reflects war experience, which has shown that it is extremely difficult to differentiate between strategic and critical materials under the old formulas. Moreover, Congress had not recognized any distinction between them in the various laws it had passed to facilitate procurement of raw materials. The new formula, it should be noted, deemphasizes dependence on "sources outside the continental limits of the United States" as a factor in determining the strategic or critical nature of raw materials. Although the geography of mineral occurrence will continue to be the principal reason for uncertainty of supply in a war emergency, the revised definition permits classification of commodities as strategic and critical for other reasons, such as lack of production capacity. Magnesium, for example, is abundantly available at home in the mineral form, but the peacetime production capacity proved to be grossly inadequate for war requirements. Thus at the outset of the defense program its procurement became a major problem, and eventually magnesium achieved strategic status of a high order.

Strategic and critical raw materials differ in essentiality and availability. All are indispensable or highly essential for war needs. For some, however, substitutes can be used at not too great a sacrifice in cost and efficiency. These factors must be considered in procurement planning. For those materials not available domestically, stock-piling is the only means of guaranteeing emergency supplies. Where existing domestic resources or substitutes can be developed for war use at acceptable costs in manpower, materials, and money, stock piles may be needed only for the period required to get production or substitution under way. For perishable strategic and critical materials procurement planning is especially complicated.

Recognizing these basic differences the Army and Navy Munitions Board has divided strategic and critical materials under its new definition into three groups, according to the practicability of stock-piling, as follows:

> Group A comprises those strategic and critical materials for which stock-piling is deemed the only satisfactory means of insuring an adequate supply for a future emergency.
>
> Group B comprises additional strategic and critical materials, the stock-piling of which is practicable. The Army and Navy Munitions Board recommends their acquisition only to the extent they may be made available for transfer from Government agencies because adequacy of supply can be insured either by stimulation of existing North American production or by partial or complete use of available substitutes.
>
> Group C comprises those strategic and critical materials which are not now recommended for permanent stock-piling because in each case difficulties of storage are sufficient to outweigh the advantages to be gained by this means of insuring adequate future supply.

The Army and Navy Munitions Board lists of materials as determined under the new definitions are not available for inclusion in this report. It may be stated, however, that minerals comprise a substantial part of the commodities classified in each of the three groups. Such lists are of course subject to revision because they must indicate technologic changes in our industrial economy, changing techniques in warfare, and broad shifts in military strategy. In the field of minerals, discovery of new deposits and depletion of known ones, as well as technologic progress, are additional factors that will bring about revisions in the strategic and critical lists.

GOVERNMENT ORGANIZATION FOR WAR

Recent editions of Minerals Yearbook have presented a brief summary of the Government agencies administering the war program with a view to preserving a chronological record of the major changes in organization and key personnel that affect the mineral industries. Minerals Yearbook, 1942, presented the story up to July 1, 1943, and this review carries the record forward to June 1944. Details of the various actions taken by these agencies are given in the commodity chapters of this volume.

Although there were many internal changes in organization and rsonnel of the war agencies in the latter half of 1943 and the first half of 1944, on the whole the Government's war organization has remained relatively stable during the past year. The Office of Emergency Management continued as an administrative agency of the Executive Offices designed to maintain liaison between the President and the war agencies. The Office of War Mobilization is the top policy-making agency under the President and is responsible for coordinating and unifying the various war activities of the Government. It also acts in an adjudicating capacity to settle differences that develop among the war groups.

By Executive Order 9425 of February 21, 1944, there was created in the Office of War Mobilization a Surplus War Property Administration, to which was given general supervision and direction of the handling and disposition of surplus war property. In view of the uncertain status of post-war mineral stocks that now constitute a threat to the stability of the mineral markets, the actions of this agency will be watched with interest by the mineral industry. W. L. Clayton, formerly Assistant Secretary of Commerce, was named Administrator, and G. Temple Bridgman, former Executive Vice President of Metals Reserve Co., was appointed Deputy Administrator.

Another significant development was the creation of the Foreign Economic Administration, to which all foreign economic operations of the Government, including the development and procurement of foreign minerals, were transferred. The new agency is discussed briefly under a separate heading in this section and in the chapter entitled "International Aspects of War Mineral Procurement."

In addition to the Foreign Economic Administration, the major direction of the war program in minerals was lodged in the War Production Board, Petroleum Administration for War, Solid Fuels Administration for War, Coal Mines Administration, and Office of Price Administration. Major changes in these agencies during the past year are recorded in the discussion that follows.

War Production Board.—The War Production Board is the chief Government agency concerned with industrial production for war, including war administration of metals and the nonmetallic minerals other than fuels. The organization of the Board, as of July 1, 1943, was described in Minerals Yearbook, 1942, but since that time many changes have been made. The most notable of these with respect to the metals and minerals programs was the creation on December 27, 1943, of the Office of Vice Chairman for Metals and Minerals. Arthur H. Bunker, Director of the Aluminum and Magnesium Division since August of 1941, was named to the new post. The Steel, Copper, and Aluminum and Magnesium Divisions, the Minerals Bureau, except the Mining Division, the Minerals Resources Coordinating Division with its subsidiary committees, and the Premium Price Quota Committee were made responsible to the Metals and Minerals Vice Chairman. Early in 1944 Howard I. Young became Deputy Vice Chairman for Production of Metals and Minerals, and Samuel W. Anderson became Deputy Vice Chairman for Distribution of Metals and Minerals. At the same time the Minerals Bureau was abolished, and its component divisions, including the Mining Division, were made directly responsible to the Metals and Minerals Vice Chairman. The Office of Vice Chairman for Metals and Minerals thus included the following industry divisions:

- Aluminum and Magnesium Division
- Copper Division
- Cork, Asbestos, and Fibrous Glass Division
- Mica and Graphite Division
- Mining Division
- Miscellaneous Minerals Division
- Steel Division
- Tin and Lead Division
- Zinc Division

Various shifts in mineral personnel took place during the past year. Hiland G. Batcheller, who served as Director of the Steel Division from September 1942, was appointed Operations Vice Chairman in June 1943, replacing Donald Davis. He resigned and was succeeded by L. R. Boulware in November, at which time the Minerals Bureau and related committees were transferred to the Vice Chairman for Metals and Minerals. In November 1943, the Mining Division announced a western mining service designed to expedite handling of mine problems through eight field offices in addition to headquarters in Denver. J. Reed Lane was placed in charge of the project. Michael Schwartz succeeded H. O. King as Director of the Copper Division on February 1, 1944. Norman W. Foy replaced John T. Whiting as Director of the Steel Division in April 1944 and was later succeeded as Deputy Director by W. T. Todd. Several other major changes in personnel occurred during the year.

A further change in organization took place in May 1944. On May 8 William Y. Elliott, Director of the Division of Stock-Piling and Transportation, succeeded Arthur D. Whiteside as Vice Chairman for Civilian Requirements. The Division of Stock-Piling and Transportation became the Stock-Piling and Transportation Bureau, with Edward Browning, Jr., as Director. On May 27 Samuel W. Anderson succeeded J. A. Krug as Program Vice Chairman. His place as Deputy Vice Chairman for Metals and Minerals was not filled. May 25 saw the organization of a Production Executive Committee Staff under the direction of Executive Vice Chairman Charles E. Wilson, "to handle readjustments that grow out of changes in military production programs." Early in June Arthur H. Bunker became Vice Chairman of the Production Executive Committee and Director of the Production Executive Committee Staff. His place as Metals and Minerals Vice Chairman was taken by Philip D. Wilson, Director of the Aluminum and Magnesium Division.

As of July 1, 1944, the members of the War Production Board and the organization units and staff dealing with policy or administration affecting the mineral industries were as follows:

WAR PRODUCTION BOARD

Members

Chairman—Donald M. Nelson
Secretary of War—Henry L. Stimson
Secretary of the Navy—James V. Forrestal
Secretary of Commerce—Jesse H. Jones
Secretary of Agriculture—Claude R. Wickard
Lieutenant General in Charge of War Department Production—William S. Knudsen

Administrator, Office of Price Administration—Chester Bowles
Foreign Economic Administrator—Leo T. Crowley
Special Assistant to the President—Harry L. Hopkins
Chairman, War Manpower Commission—Paul V. McNutt
Director, Office of Defense Transportation—J. Monroe Johnson
Petroleum Administrator for War—Harold L. Ickes
War Food Administrator—Marvin Jones

Staff

- Executive Office of the Chairman
  - Office of War Utilities, Director—Edward Falck
    - Power Division, Director—B. J. Sickler
    - Manufactured-Gas Division, Director—Alexander Macomber
    - Natural-Gas Division, Director—Paul R. Taylor
  - Vice Chairman for Civilian Requirements—William Y. Elliott
    - Metals and Minerals Division, Director—Carroll Burton
  - Vice Chairman for Smaller War Plants—Maury Maverick
- Executive Vice Chairman—Charles E. Wilson
  - Deputy Executive Vice Chairman—Arthur H. Bunker
- Program Vice Chairman—S. W. Anderson
  - Requirements Committee, Chairman—S. W. Anderson
  - Program Bureau, Director—Lincoln Gordon
  - Orders and Regulations Bureau, Director—Thomas C. Blaisdell, Jr.
  - Production Controls Bureau, Director—Harold Boeschenstein
  - Distribution Bureau, Director—W. J. Logan
  - Bureau of Stock Piling and Transportation, Director—Edward Browning, Jr.
- Vice Chairman—Donald D. Davis
  - Deputy Vice Chairman for Field Operations—Harcourt Amory
  - Facilities Bureau, Director—John B. McTigue
  - Office of Production Research and Development, Acting Director—Donald B. Keyes
  - Procurement Policy Division, Director—Tudor Bowen
  - Bureau of Planning and Statistics, Director—Stacy May
- Vice Chairman (International Supply)—William L. Batt
- Vice Chairman for Labor Production—Joseph D. Keenan
  - Plant Productivity Division, Director—George W. Brooks
    - Raw Materials Section, Chief—William Munger
- Vice Chairman for Manpower Requirements—Clinton S. Golden
  - Labor Requirements Division, Acting Director—David Ziskind
    - Raw Materials Branch, Chief—Allen Buchanan
- Operations Vice Chairman—L. R. Boulware
  - Deputy Vice Chairman for Operations—Wade T. Childress
  - Office of Industry Advisory Committees, Director—John C. Whitridge, Jr.
  - Office of Product Assignments, Director—G. A. Stuart
  - Conservation Division, Director—Howard Coonley
  - Redistribution Division, Director—Col. Charles R. Baxter
  - Salvage Division, Director—Herbert M. Faust
  - Chemicals Bureau, Director—D. P. Morgan
  - Consumers Hard Goods Bureau, Acting Director—Wade T. Childress
  - Equipment Bureau, Director—William K. Frank
- Vice Chairman for Metals and Minerals—P. D. Wilson
  - Deputy Vice Chairman for Production—Howard I. Young
  - Aluminum and Magnesium Division, Acting Director—Thomas E. Covel
  - Copper Division, Director—Michael Schwartz
  - Mineral Resources Coordinating Division, Director—Howard I. Young
    - Minerals and Metals Advisory Committee, Chairman—Howard I. Young
      - War Department—Lt. Col. John A. Church
      - Navy Department—Comdr. J. W. Palen
      - Bureau of Mines—R. S. Dean
      - Reconstruction Finance Corporation—Simon D. Straus
      - Geological Survey—Donnel F. Hewett
      - Foreign Economic Administration—Alan M. Bateman
      - Bureau of Foreign and Domestic Commerce—Walter Janssen
      - Office of Civilian Requirements—Carroll Burton
      - Office of Production Research and Development—C. K. Leith
      - Facilities Bureau—Ellsworth R. Bennett

        Office of Manpower Requirements—Clinton S. Golden
        State-Department—C. E. Gamper
        Bureau of Stock-Piling and Transportation—Edward Browning, Jr.
    Minerals Resources Operating Committee, Chairman—Howard I. Young
        Bureau of Mines—R. S. Dean
        Foreign Economic Administration—Alan M. Bateman
        Reconstruction Finance Corporation—H. DeWitt Smith
        Office of Production Research and Development—Donald B. Keyes
Steel Division, Director—Norman W. Foy
    Deputy Director—W. T. Todd
    Asst. Director for Raw Materials and Facilities—H. J. French
        Plant Facilities Branch, Chief—H. W. Bryant
        Metallurgical Branch, Chief—E. J. Hergenroether
        Raw Materials Branch, Chief—Alex Miller
    Asst. Director for Production—C. H. Longfield
    Asst. Director for Program and Distribution—S. A. Crabtree
    Asst. Director for Manpower (Acting)—P. J. Clowes
    Asst. Director for Ferro-Alloys—E. Franklin Hatch
    Cork, Asbestos, and Fibrous Glass Division, Director—William T. Melov
    Mica-Graphite Division, Director—M. H. Billings
    Mining Division, Director—Arthur S. Knoizen
    Miscellaneous Minerals Division, Director—Richard J. Lund
    Tin and Lead Division, Director—Erwin Vogelsang
    Zinc Division, Director—James Douglas

Office of Price Administration.—The Stabilization Act of 1944 extended the authority for price controls 1 year to June 30, 1945. The act provided for some procedural changes and minor shifts in policies applicable to specified commodities. No changes in regard to mineral price policies were involved. However, moderate increases in ceiling prices for solid and liquid fuels were granted during the year. Very few increases were authorized for other minerals. The premium-price plan for copper, lead, and zinc continued in effect throughout 1943.

Chester A. Bowles succeeded Prentiss M. Brown as Administrator in October, and in August 1943 James F. Brownlee replaced Donald H. Wallace as Deputy Administrator for Price. As of July 1, 1944, the following units and executives of the Price Department were administering prices for minerals:

Industrial Materials Price Division:
    Director—John S. Clement
    Office of Metal Mining Analysis, Director—Jesse L. Maury
    Building Materials Branch, Price Executive—Karl Mathiason
    Nonferrous Metals Branch, Price Executive—Karl L. Anderson
    Iron and Steel Branch, Price Executive—Warren M. Huff
Industrial Manufacturing Price Division, Director—John S. Clement
    Chemicals and Drugs Branch, Acting Price Executive—Lester V. Chandler
Fuel Price Division, Director—Sumner Pike
    Petroleum Branch, Price Executive—Orville Judd
    Solid Fuels Branch, Price Executive—G. G. Johnson

Petroleum Administration for War.—This agency has continued to operate under the provisions of Executive Order 9276 of December 2, 1942; hence the primary purpose of administrative changes since January 1943 has been to adapt the organization to new conditions as they became apparent.

The most significant internal change in 1943 was a decentralization of authority by which power was delegated to the five district directors to act upon many operating problems. Under this system the judgment of men who are intimately acquainted with local conditions prevails with respect to questions of essentially local importance, and much of the delay and expense to operators attendant upon direct dealing with Washington has been eliminated.

Growing emphasis upon the foreign oil situation led to the creation of three divisions concerned with this field—The Production, Refining, and Supply and Transportation Divisions—in place of the old Foreign Division. Close relations are maintained with the Petroleum Board and the Foreign Petroleum Committee, both of which are interagency groups established in February 1943 to aid in the formulation and coordination of Government policy with respect to petroleum. A Foreign Operating Committee, similarly constituted, is concerned with the immediate problems involved in the supply of petroleum and products from foreign sources for the Allied armed forces.

The organization and principal officials of the Petroleum Administration for War on June 1, 1944 were as follows:

Administrator—Harold L. Ickes
Deputy Administrator—Ralph K. Davies
Assistant Deputy Administrator—Bruce K. Brown
Assistant Deputy Administrator and Chief Counsel—J. H. Marshall
Executive Officer—E. L. Kohler
Director of Organization Planning—W. H. Newman
Labor-Manpower Counselor—F. H. Harbison
Production Division—D. R. Knowlton, Director
Refining Division—E. D. Cumming, Director
Supply and Transportation Division—G. A. Wilson, Director
Distribution and Marketing Division—W. Hochuli, Director
Natural Gas and Natural Gasoline Division—J. E. Pew, Director
Foreign Production Division—W. B. Heroy, Director
Foreign Refining Division—C. S. Snodgrass, Director
Foreign Supply and Distribution Division—W. D. Crampton, Director
Materials Division—C. P. Parsons, Director
Facility Security Division—W. K. McCoy, Director
Research Division—E. B. Swanson, Director
Public Relations Division—S. W. Robinson, Director
Construction Division—George Gibson, Director
Program Division—S. P. Coleman, Director

In fulfilling its responsibilities to the armed forces and United States civilians the Petroleum Administration for War has guided the activities of the petroleum industry and integrated its policies and supply problems with the Nation's war program. The method by which supply and demand are coordinated is briefly sketched below.

To determine the total prospective demand for petroleum, the several cognizant agencies of Government certify monthly to the Petroleum Administration the future needs for petroleum products of the consuming activities controlled by each. The Petroleum Administration allocates the anticipated supply to the various consuming groups with necessary adjustments favoring the types of use regarded as most important to the prosecution of the war. The discrepancy indicated by forecasts of demand and supply is translated into operating adjustments within the petroleum industry designed to produce the quantity and quality of products required for all essential war purposes.

Solid Fuels Administration for War.—This agency was established within the Department of the Interior by Executive Order 9332 on April 19, 1943, to centralize the Government's programs and policies covering the supply of anthracite, bituminous coal, and lignite for essential war and civilian requirements. It succeeded the Office of Solid Fuels Coordinator for War (so designated on May 25, 1942), which had succeeded the Office of Solid Fuels Coordination for National Defense set up at the request of the President to the Secretary of the Interior on November 5, 1941.

On December 1, 1943, the War Production Board by Directive 33, together with a later amendment, delegated to the Solid Fuels Administration for War authority to regulate coke for distribution as a domestic fuel.

The Secretary of the Interior, as Solid Fuels Administrator for War, is authorized by the Executive order establishing S. F. A. W. to establish policies and formulate plans and programs to assure the most effective wartime distribution, conservation, and utilization of solid fuels, to issue necessary policy and operating orders, to appoint any necessary industry, committees, or councils, and to take appropriate steps for stimulating increased production.

The Solid Fuels Administration for War collects data from the solid fuels industries and other sources, both private and Government and, upon the basis of such data, makes recommendations to other Government agencies concerning prices, equipment, manpower, and transportation for the solid fuels industries.

The Administrator also has the power to determine the times and areas within which rationing of solid fuels should become effective; and he exercises, with respect to solid fuels and subject to the direction of the Chairman of the War Production Board, the allocation and rationing power of the President conferred by the Second War Powers Act, 1942.

Field offices have been established by the Solid Fuels Administration for War at key points throughout the major coal consuming areas to enable it to keep closely advised of the adequacy of the coal supply throughout the country in time to take any corrective action necessary.

Charles J. Potter succeeded Howard A. Gray (retired) as Deputy Administrator in November 1943, and in May 1944 the Economics and Statistics Division was transferred to the Bureau of Mines.

As of July 1, 1944, the organization of the Solid Fuels Administration was as follows:

Administrator—Harold L. Ickes
Deputy Administrator—Charles J. Potter
Consultant—Thomas J. Thomas
Consultant—James W. Morgan
Assistant Deputy Administrator for Transportation—Fred K. Prosser
Assistant Deputy Administrator for Coke—Harlen M. Chapman
Assistant Deputy Administrator for Prices, Manpower and Administration—Dan H. Wheeler
Special Assistant to the Deputy Administrator—Arnold Levy
Head Administrative Officer—John E. MacDonald
Chief, Anthracite Distribution Division—Robert F. Duemler
Chief, Bituminous Distribution Division—William F. Hahman
Chief, Coke Distribution Division—Samuel Weiss
Chief, Compliance Division—Charles H. Hayes
Chief, Conservation Division—Allen W. Thorson
Chief, Field Office Division—N. O. Wood, Jr.
Director of Information—Leonard W. Mosby
General Counsel—Jesse B. Messitte

Advisory bodies providing counsel to the Solid Fuels Administration include the following:

Solid Fuels Advisory War Council
National Anthracite Distribution Committee
Regional Anthracite Distribution Committees
Producer Advisory Boards for the 22 bituminous coal production districts
Lake Dock and Tidewater Dock Advisory Committees
National Advisory Coke Committee
National Committee on Local Distribution
Area Advisory Committees on Local Distribution
Community Committees on Emergency Distribution

Coal Mines Administration.—This agency was set up in July 1943 to supervise the operation of the anthracite and bituminous-coal mines in Government possession. The Secretary of the Interior, acting under authority of Executive Order 9340, on May 1, 1943, took over in behalf of the Government the coal-mining properties of 259 anthracite companies and 2,182 bituminous companies. These companies owned mines producing 50 tons or more per day and strikes had either halted or threatened to interrupt their output. During the initial period of Goverment possession the supervison of the mines was handled by the Solid Fuels Administration for War. Then the Secretary of the Interior established the Coal Mines Administration and transferred mine supervision to that agency.

The first period of Government possession was concluded on October 12, 1943, when all the mines then remaining in Government possession were returned.

Under authority of Executive Order 9393, the Secretary of the Interior again took possession of 3,223 mines belonging to 2,173 companies on November 1, 1943, after another Nation-wide series of strikes, and on November 3 concluded a Memorandum of Agreement with the United Mine Workers of America for the period of Government possession. After new agreements had been effectuated between the mine owners and mine labor, Government possession of the mines was gradually terminated, and on June 21, 1944, all the mines then remaining in Government possession, with the exception of two which belonged to one bituminous company, were turned back to their private owners.

Organization of the Coal Mines Administration during late 1943 and early 1944 was as follows:

Administrator—Harold L. Ickes
Deputy Coal Mines Administrator—Charles J. Potter
Assistant Deputy Administrator—Dan H. Wheeler
Assistant Deputy Administrator and Acting Associate Director Health and Safety Division—J. W. Morgan
Consultant—Harry G. Kennedy
Head Administrative Officer—J. E. MacDonald
General Counsel—Arnold Levy
Consultant, Labor Relations—Oral L. Garrison
Health and Safety Division—R. R. Sayers, Director
Health and Safety Division—Harrison Combs, Associate Director
Finance and Accounting Division—Joseph J. Mansolf
Information Division—Leonard W. Mosby, Chief

Foreign Economic Administration.—This agency, which was created by Executive Order 9380 issued on September 25, 1943, directs the vast foreign economic activities of the United States Government, including the procurement of minerals from abroad. The establishment of this agency culminated a series of consolidations, one of the most important of which was Executive Order 9361, issued on July 15, 1943, which merged in an Office of Economic Warfare the former Board of Economic Warfare, the Export-Import Bank, and various procurement subsidiaries of the Reconstruction Finance Corporation. The Office of Economic Warfare, the Office of Lend-Lease Administration, and other units dealing with foreign economic operations subsequently were brought together to form the Foreign Economic Administration. Leo J. Crowley was designated as Administrator.

The agency operates through two major bureaus—a Bureau of Supplies of which Sidney H. Scheuer is Executive Director and a Bureau of Areas directed by James L. McCamy. Mineral procurement is carried on in a Foreign Procurement and Development Branch, of which Paul H. Nitze is Director.

Negotiation of foreign minerals procurement contracts is handled by the F. E. A., and purchases are made in the name of its fiscal agent, United States Commercial Co., a United States Government-owned corporation. This has been true since September 1943 when the foreign procurement functions of Reconstruction Finance Corporation were transferred to United States Commercial Co. In general, Metals Reserve Co., an R. F. C. subsidiary, agreed to purchase foreign metals and minerals from United States Commercial Co. ex dock at United States ports of entry or f. o. b. cars at border points and to undertake the sale and distribution of such materials. This transfer signalized the completion of the withdrawal of the R. F. C. from the foreign minerals procurement field, with the exception of continued responsibility for several large development projects, financed by the Defense Plant Corporation.

With this exception, actual operations in the foreign minerals procurement field are conducted by the Metals and Minerals Divisions of the Foreign Procurement and Development Branch in the F. E. A. Key officials on the technical staff of these two divisions and of the associated Technical Services Division were as follows on July 1, 1944:

Associate Director of Foreign Procurement and Development Branch—Alan M. Bateman
Metals Division, Chief—Spencer S. Shannon
    Copper Section, Chief—Mahlon Miller
    Zinc-Lead Section, Chief—Vacancy
    Tin, Mercury, Antimony, Bauxite Section, Chief—Clarence E. Peterson
    Ferro-Alloy Section, Chief—Horace J. Fraser
    Scrap Metals Section, Chief—Benjamin Schwartz
Minerals Division, Chief—David C. Sharpstone
    Minerals Division, Assistant Chief—Hugh E. McKinstry
    Mica-Graphite Section, Chief—Richard H. Vail
    Quartz-Optical Calcite Section, Chief—Carl Tolman
    Asbestos, Fluorspar, Diamonds Section, Chief—Henry A. Behre
    Rare Minerals Section, Chief—James S. Baker
    Alloy Minerals Section, Chief—Vacancy
Technical Services Division, Chief—Vacancy
    Economic and Area Liaison Section, Chief—John W. Evans
    Engineering Analysis and Commodity Section, Chief—Robert K. Warner
    Service and Supply Section, Chief—Paul Hendrick

INTERNATIONAL ASPECTS OF THE WAR MINERAL PROGRAM

By J. S. McGrath

SUMMARY OUTLINE

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GENERAL SUMMARY

International economic relations during 1943 continued to be influenced to a major degree by the necessities of war. However, toward the end of the year cooperative arrangements among the United Nations with respect to distribution of available supplies essential to wartime operations had been so successful that serious consideration of readjustments to minimize post-war problems became imperative. This applied particularly to the mineral production and development program. Output of many mineral raw materials reached a peak during 1943, and in most instances the available supplies were adequate to meet anticipated requirements far into 1944. This situation applied to the United States and its Allies as well as to neutral countries with which the Allies maintained friendly relations. For a few minerals, surpluses developed during the year or at the stimulated rate of production could be anticipated. This trend toward an excess over wartime needs led to discussions in official and industrial circles of national policies relating to controls of mineral production, import regulations, stock-piling programs, and necessary adjustments of existing Government-to-Government agreements originally enacted for the primary purpose of acquiring strategic and critical raw materials. Consideration also was given to the need for post-war international cooperation through some form of organization that may effectively prevent the collapse of free enterprise as this term relates to article IV of the Atlantic Charter, which seeks equal access by all nations or the trade and raw materials of the world that are essential to theit economic welfare.

Control of mineral production and imports.—Except during war emergencies, the mining industry of the United States has been singularly free from direct Government restrictions or controls on production. Export controls—a device used in many countries for various purposes—have been nonexistent in the United States in times of peace. In recent years some control of petroleum and bituminous-coal production has accompanied the Government attempt to effect conservation practices or achieve greater stability in those industries. Although rigid control of mineral resources has been proposed from time to time as a conservation measure, it has never been adopted as national policy. The prospect of United States participation in international economic cooperation presupposes a large measure of control, particularly over those commodities that enter world trade in substantial quantities. As minerals comprise a very important part of the foreign trade of the United States and as some measure of post-war international collaboration seems assured, more active participation in the affairs of the mining industry by the Government likewise seems inevitable.

Interrelated with potential production and export controls is the consideration of adjustments in tariff policy, which must be treated as a complementary problem. That industry is cognizant of the seriousness of the post-war conditions that will confront producers and fabricators of mineral raw materials as well as Government may be gleaned from an editorial in Engineering and Mining Journal, December 1943 (pp. 76–82) directing attention to "Important Factors in the Outlook for Mining," and an article by Evan Just, associate editor, Engineering and Mining Journal, that suggests a "National Policy on Mineral Imports," April 1944 (pp. 70–73). Both references stress the inescapable complications that must be faced during the post-war period of transition from a wartime to a peacetime economy. Particular emphasis is placed on the need for adopting a national policy that will assure access by industry to necessary raw materials from domestic or from foreign sources, whichever may be obtainable upon the most economic basis. Some form of quota system is suggested, which would allocate tonnages to be supplied from domestic and foreign sources. A workable formula of such a system would involve detailed analyses of each industry and careful study of and ultimate decisions relating to the capacity of domestic producers to supply and the United States market to consume, comparative production costs, and problems concerning depletion of domestic reserves, conservation of dwindling resources, and competitive substitutes. The practicability of such a quota system has already been explored and applied to certain commodities involved in the trade agreements program initiated by the United States 10 years ago.

Stock-pile proposals.—Stock-piling of essential metals and minerals, as a wartime necessity, has been in effect since 1939, under Congressional authority (Public 117, 76th Congress). For peacetime stability, numerous proposals were studied throughout 1943 by the Congress, by the United States departments of War, Navy, State, and the Interior, and by the Foreign Economic Administration. However, differences of opinion relating to administrative details of the program and the extent of preference that should be given domestic and foreign sources of supply precluded adoption during 1943 of any suitable form of legislation. Details concerning some of the stock-piling proposals will be found elsewhere in the Yearbook.

Significance of wartime imports.—Detailed statistics of domestic production during 1943 and data relating to imports essential to meet industrial requirements will be found in the commodity chapters of Minerals Yearbook. The evident dependence of this country on foreign sources of supply for a substantial part of its wartime needs and the obligation to consider seriously the future effect of the wartime demands of the United Nations upon sources of supply within the Western Hemisphere are clearly indicated by the large increases in imports of certain essential materials into this country in 1943 over any pre-war year, as, for example, 1938. The increase in imports of manganese ore in 1943 was about 158 percent and of chrome ore 135 percent; imports of aluminum and bauxite, copper, lead, zinc, tungsten ores, nickel in various forms, vanadium ore, antimony, and mercury showed similar marked increases in 1943 compared with 1938. These comparisons, though exaggerated by war conditions, evidence a declining self-sufficiency in minerals in the United States and indicate the wide variety of post-war problems that will confront management, labor, and Government in this country. Substantial curtailment of war demands at the close of this war will adversely affect the principal producing nations of this hemisphere because the Government-to-Government agreements enacted during 1942 and 1943 greatly stimulated their output of minerals and contributed to the improvement of their internal economies. This applies especially to the Latin American countries.

GOVERNMENT-TO-GOVERNMENT AGREEMENTS FOR THE ACQUISITION OF MINERAL RAW MATERIALS

The primary purposes for negotiating over-all agreements between this country and other nations of the Western Hemisphere were to assure our industries adequate supplies of vital strategic materials and to prevent the procurement of such raw materials by enemy countries. Since January 1943 three of the four original over-all Government-to-Government agreements have been renewed with Chile, Mexico, and Peru, and the original agreement with Brazil was extended to September 15, 1944, insofar as it relates to quartz crystal and mica purchases.

Chile.—The initial agreement between the Governments of the United States and Chile, which was negotiated for the primary purpose of acquiring copper, expired July 19, 1943, but was extended to August 1, 1944, by an exchange of diplomatic notes. The agreement has flexible provisions relating to purchases, deliveries, and prices f. o. b. steamer Chilean ports of copper ores and concentrates, lead ores and concentrates, zinc ores and concentrates, gold ores and concentrates, manganese ore, mercury, antimony ores, cobalt ores and concentrates, molybdenum ores and concentrates, and tungsten ores and concentrates. Purchases during the year ending August 1944 are limited to specified tonnages. The Chilean Government agreed to restrict exportation of these strategic minerals to the United States, the British Empire, and other countries of the Western Hemisphere that have satisfactory systems of export control and to limit domestic consumption of copper and manufactures thereof to specified tonnages which precludes its use for unessential purposes.

Mexico.—Through an exchange of diplomatic notes concluded on June 30, 1943, the original Mexican over-all agreement of July 15, 1941, and its amendment of April 29, 1942, were superseded by an arrangement that provides for the purchase by the United Nations of exportable surpluses of all strategic minerals from Mexico included in the original amendment. It also carries the provision that the agreement will remain in effect until April 29, 1944, and thereafter unless terminated by either Government on 6-months' notice. The minerals covered by the agreement, whether in ore, concentrates, or metallic form, include antimony, arsenic, bismuth, cadmium, cobalt, copper, fluorspar, graphite, lead, manganese, mercury, mica, molybdenum, tin, tungsten, vanadium, and zinc.

Peru.—In January 1943 a draft of an agreement between the United States and Peru was submitted that would have extended the original agreement with Peru that expired on September 29, 1941, after having been in effect for 1 year. Differences of opinions concerning certain tax policies of the proposed agreement resulted in protracted discussions, and Peruvian mineral producers and exporters during the first few months of 1943 were directly and adversely affected. Finally, on July 20, 1943, an accord between the two countries was reached effective until June 30, 1944. The agreement provides for the purchase by this country, the British Empire, and any American republics that have a satisfactory system of export control, of copper ores and concentrates, lead ores and concentrates, gold contained in complex ores, zinc metal, ores and concentrates, mercury, tungsten ores and concentrates, molybdenum ores and concentrates, and antimony ores and concentrates, all of which materials are specifically provided for as to grades and purchase prices.

Other agreements.—An agreement with Colombia for a year's purchase of platinum was negotiated in March 1942. In March 1943 the original contract was renewed with some revisions relating to crude platinum, the entire Colombian output of which was for shipment to the United States until expiration of the agreement on March 17, 1944.

On October 22, 1940, 5-year contracts were signed between the National Resources Commission, an agency of the Republic of China, and the Metals Reserve Co., representing the United States Government, which were negotiated for the dual purpose of providing a loan of $25,000,000 by this country to China and the acquisition by this country of Chinese tin, tungsten, and antimony; a second contract for the purchase of these strategic metals over a period of 7 years, involving a loan of $50,000,000 to China, was signed January 31, 1941. The second contract was amended for the fourth time on January 4, 1943, in an endeavor to speed deliveries of badly needed tin and tungsten to the United States.

ECONOMIC WARFARE PROGRAM

Agencies created to prosecute economic warfare.—Many Government agencies have contributed to the wartime foreign production and procurement program, and there have been several reorganizations and mergers of such offices. Some Federal organizations created "to produce, acquire, and carry strategic and critical materials as described by the President" were established by the Congress through specific legislation, whereas others were created by Executive order. Public 664, 76th Congress, 3d session, approved June 25, 1940, and an amendment thereto (Public 108, 77th Congress, 1st session, approved June 10, 1941) authorizing the Reconstruction Finance Corporation to organize and finance corporations for the purpose of purchasing essential raw materials, is an illustration of the former type of legislative authorization. The several agencies created by Executive order before 1943 that were authorized to participate in one phase or another of the wartime production and procurement program are described in the chapter on this subject that appears in Minerals Yearbook, 1942.

On July 15, 1943, the Office of Economic Warfare was established by Executive Order 9631. To it were transferred all the functions of the former Board of Economic Warfare and those of the United States Commercial Co., the Rubber Development Corporation, Petroleum Reserves Corporation, and the Export-Import Bank, with the functions and responsibilities of those subsidiaries of the Reconstruction Finance Corporation that were directed toward foreign production and procurement activities. To consolidate further all agencies directly responsible for the existing relief, rehabilitation, and development and procurement programs, the Foreign Economic Administration was established by Executive Order 9380 on September 25, 1943. The Administration represents a consolidation into one administrative organization of the former Office of Lend-Lease Administration, Office of Foreign Relief and Rehabilitation Operations, Office of Economic Warfare (including those agencies aforementioned), and that part of the Office of Foreign Economic Coordination, United States Department of State, which formerly was responsible in part for Government-to-Government negotiations. By the end of 1943 it appeared reasonably certain that, for the duration of the war, the war-mineral program of this country with respect to the procurement and development of vital materials abroad would remain a function and responsibility of the Foreign Economic Administration.

Iron ore and coal are the only major war minerals which the United States has been able to supply from domestic sources in adequate volume to meet its wartime requirements, consequently metals and minerals represent the largest commodity group in the foreign procurement and development program initiated by this country some time before hostilities began in December 1941. During 1943 the program extended to the Caribbean area, Mexico, Central America, all but two of the countries of South America, several parts of Africa, India, China, Australia, and the South Pacific.

According to the Foreign Economic Administrator, deliveries of strategic commodities from foreign countries purchased with United States Government funds during 1943 were valued at $809,000,000, of which $496,000,000 or 61.3 percent represented expenditures for mineral purchases. These figures do not include purchases or deliveries made under the auspices of the Foreign Economic Administration for private account or purchases made under the preclusive buying policy adopted for the purpose of preventing delivery to the enemy of essential raw materials produced in neutral countries. Government purchases during the year included many imported mineral commodities, such as beryl, chrome, copper, fluorspar, manganese, mica, nickel, quartz crystal, tantalite, tin, and zinc.

GENESIS OF CURRENT TREND TOWARD INTERNATIONAL ECONOMIC COLLABORATION

The Atlantic Charter.—The fourth article of the joint declaration of the President of the United States and the Prime Minister of Great Britain, commonly known as the Atlantic Charter, dated August 14, 1941, provides that members of the United Nations, including all countries that have since that date subscribed to the original declaration "will endeavor, with due respect for their existing obligations, to further the enjoyment by all States, great or small, victor or vanquished, of access on equal terms to the trade and to the raw materials of the world which are needed for their economic prosperity."

First joint declaration of the United Nations.—On January 1, 1942, the 27 countries then comprising the United Nations subscribed to a joint declaration, the purpose of which was to insure maximum cooperation in the war effort and which pledged employment of "full resources, military and economic," against the enemy.

The Moscow Conference.—Articles IV and V of a general security pact signed at Moscow on October 30, 1943, by Secretary of State Cordell Hull and corresponding officials representing the Governments of the United Kingdom, the Soviet Union, and China, provides that these Nations

> Recognize the necessity of establishing at the earliest practicable date a general international organization, based on the principle of the sovereign equality of all peace-loving States and open to membership by all such States, large or small, for the maintenance of international peace and security; that for the purpose of maintaining international peace and security pending the reestablishment of law and order and the inauguration of a system of general security, they will consult with one another and as occasion requires with other members of the United Nations with a view to joint action on behalf of the community of nations.

The Tehran Conference.—At the capital of Iran on December 1, 1943, the Tehran declaration was signed by the President of the United States, the Prime Minister of Great Britain, and the Premier of the Soviet Union. In this document they acknowledged the

> responsibility resting upon us and all the United Nations to make a peace which will command the good will of the overwhelming mass of the people of the world;

it was also declared that

> We shall seek the cooperation and active participation of all nations, large or small * * * and will welcome them as they may choose to come into a world family of Democratic Nations.

PLANNING FOR POST-WAR ECONOMIC COLLABORATION

The war program has emphasized many factors that probably will present international post-war problems of major significance. These developments, in the light of the apparent determination both here and abroad to devise some practical means of achieving collective security through international cooperation, focus attention on the importance of foreign policy in our future mineral economy. They also indicate clearly the need for prompt consideration of these problems in this country and abroad under Government and private auspices which may lead to the adoption of policies that can at least minimize destructive post-war competition for international markets upon which the economy of so many countries depends.

Although the principle of international cooperation on a broader scale than before the war is endorsed by the United Nations, as previously indicated, nothing concrete developed in the form of a definite program either in this country or abroad during 1943 or the early part of 1944. In this country congressional delegations have been appointed to confer with the United States Department of State to insure harmony between the legislative and executive branches of Government on matters relating to post-war planning. Congressional committees, as well as similar groups in several executive departments have been set up to conduct studies and consider proposals relating to economic and political aspects of international arrangements that may ultimately serve as the basis for international discussions of post-war problems. A similar situation prevailed at the outset of 1944 in most of the United Nations.

Discussions on an international scale have been held with respect to post-war planning of food distribution and monetary problems, and in regard to food distribution and health of nationals of war-torn countries an international organization has been created to cope with the problem (United Nations Relief and Rehabilitation Administration). However, no intergovernmental action has been taken with respect to minerals, with the single exception of exploratory discussions on petroleum between the United States and the United Kingdom in April 1944. These discussions were predicated on the recommendation by both countries that adequate petroleum supplies must be available for free international trade to insure the security and prosperity of all nations; that for the foreseeable future, petroleum resources of the world must assure ample supplies to meet market requirements; and that the anticipated increase in world demand for petroleum products must be satisfied by the orderly flow in international trade of petroleum from the various producing countries of the world. Similar discussions relating to other mineral products may be anticipated.

The gravity of inescapable problems confronting domestic producers at the outset of 1944, which to some degree are common to all countries where mineral output is a major factor in the internal economy, is recognized both in Government and in private industrial circles. Responsibility of the major powers for maintaining world stability in the sense of national security for all countries and the relationship to this problem of access to and balanced distribution of mineral raw materials through political or economic control of mineralized areas has received considerable attention since the end of World War I.

To statesmen and industrial leaders in this country and abroad it appears evident that at the conclusion of the present conflict Government control or regulation of mineral production and distribution in one form or another will be adopted by many countries. Trends in this direction or at least indications that serious thought is being given to the relationship between control of mineral resources and post-war security and national prosperity is evidenced by the movement toward international economic collaboration among the United Nations which began late in 1943 and has become more pronounced as victory for the Allies seems assured. Although the principle involved is recognized as a post-war necessity, no definite plans have as yet crystallized. However, discussions in official circles in the United States include proposals to rejuvenate the Reciprocal Trade Agreements Act enacted by the

Congress in 1934 for a period of 3 years but extended on three occasions and now in effect until June 1945. Agreements were negotiated under this act before Pearl Harbor between the United States and 27 foreign countries. Negotiations with Bolivia, Paraguay, Chile, Italy, and Spain were postponed for the duration of the war. Reduction of excessive trade restrictions, chiefly prohibitive import duties, which is the fundamental principle of the act, has been suggested as a possible theme upon which the United Nations might develop a formula of collaboration for the settlement of problems of discriminatory exchange regulations and taxation practices, restrictions and prohibitions on foreign investments, and the activities of international cartels and monopolies that hamper the full development of technologic improvements.

STATISTICAL SUMMARY OF MINERAL PRODUCTION

(GENERAL UNITED STATES SUMMARY AND DETAILED PRODUCTION BY STATES)

By MARTHA B. CLARK AND MARIAN E. MEYER

SUMMARY OUTLINE

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INTRODUCTION

This report continues the series of annual statistical summaries published in previous years as chapters of Mineral Resources and Minerals Yearbook.

In order to meet the need of industry and the States for up-to-date statistics on State production of minerals, State summaries are presented for the current year for the first time since 1931, after which the Minerals Yearbook series was established. This speeding up of the compilation of State data is possible as steady progress has been made in statistical techniques in recent years. Because of the early date of publication, the fuel figures for 1943 are estimates subject to revision; it is believed, however, that the data shown represent a high order of accuracy.

UNIT OF MEASUREMENT

The unit of measurement used by the Bureau of Mines for each mineral product in reports on the mineral resources is that common to the industry concerned, and the variation in these units makes it impracticable, if not impossible, directly to combine and compare the different minerals except as to value. Although most of the products are measured by weight, some are measured by volume and some by number of "pieces," etc.; for some no total quantity figures are available.

ELIMINATION OF DUPLICATION

In the totals for the United States, shown in the following "general" tables, duplication has been eliminated wherever practicable, and in the State totals given in the State tables virtually all duplication has been eliminated. For instance, in both general and State tables the output of coke is shown but its value is not included in the totals, as the value of the coal used in its manufacture enters into the value of the coal production which is included in the totals. For asphalt, both native and oil are shown in the general tables, but the value of the oil asphalt is excluded from the totals as it duplicates that of the petroleum from which it is manufactured. For the clay industries, no figures have been available for total clay produced. For years before 1936, the total value of clay products is included in both general and State totals as representing the first marketable form of the greater part of the clay produced; the quantity and value of the clay mined and sold in the raw state by miners to users of clay are shown separately also, but the value is not included in the totals as it is duplicated largely in that for clay products. For years beginning with 1936, as the Bureau of Mines believes that a closer approach to the value of domestic clay in its first marketable form results from the inclusion of the value of clay sold by producers and of clay products other than pottery and refractories, the United States and State totals include such values for the clay industries. This change in practice should be borne in mind when comparing the values beginning 1936 with those for earlier years.

United States totals.—In the general tables both iron ore and pig iron are shown, but the value of the pig iron rather than the iron ore is included in the United States totals, as that is considered the better means of presenting the statistics for iron in its first marketable form. For gold, silver, copper, lead, and zinc the value of "smelter output" is included in the general totals, and to account more fully for the value of the ores treated these smelter figures are supplemented by the value of the byproduct sulfuric acid. The value of pigments (white lead, red lead, lithopone, litharge, and orange mineral) manufactured from metals is not included in the general tables, as the base from which they are made is included in the output of lead or zinc, whereas the value of sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide is included, as these are made in large part direct from the ores and do not enter into the lead or zinc totals, which represent smelter output.

State totals.—In the State tables also iron ore and pig iron are both shown. As blast-furnace products cannot be traced to the States in which the ore is mined, the value of the ore is used in the State totals. For ores of gold, silver, copper, lead, and zinc no values are shown, and in fact none are recorded; instead, for each of these metals the recoverable content of the ores is used as the basis of valuation. The value of the zinc and lead pigments is not included in the State total, as the recoverable zinc and lead content of the ores from which the products were made is included under zinc or lead. The value of the sulfuric acid produced as a byproduct of copper, lead, and zinc smelting and zinc roasting is not included in the State total, as tracing this product back to the State producing the ore has not been possible.

GENERAL TABLES

Mineral products of the United States, 1941–43[1]

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
METALLIC						
Aluminum ...short tons (2,000 pounds)	309,067	$100,395,000	521,106	$151,371,000	920,179	$265,380,000
Antimonial lead ...do	[2] 40,237	(2)	[2] 51,762	(2)	[2] 63,515	(2)
Antimony:						
Metal ...do	(3)	(3)	(3 4)	(3 4)	(3 4)	(3 4)
Ore and concentrates ...do	3,460	136,000	(4 5)	(4 5)	(4 5)	(4 5)
Bauxite ...do	1,011,090	5,358,976	2,940,463	12,934,025	7,496,250	32,744,109
Beryllium ore ...do	158	7,300	(4 5)	(4 5)	(4 5)	(4 5)
Cadmium:						
Metal ...pounds	7,044,417	5,498,404	(4 5)	(4 5)	(4 5)	(4 5)
In compounds ...do	265,700	207,246	(4 5)	(4 5)	(4 5)	(4 5)
Chromite ...short tons	14,259	274,062	(4 5)	(4 5)	(4 5)	(4 5)
Copper,[6] sales value ...do	966,072	227,993,000	1,087,991	[7] 256,766,000	1,092,939	[7] 257,934,000
Ferro-alloys ...do	1,719,785	204,856,619	(4 5)	(4 5)	(4 5)	(4 5)
Gold[8] ...troy ounces	5,976,419	209,174,600	3,741,806	130,963,210	1,394,522	48,808,270
Iron:						
Ore[9] ...long tons (2,240 pounds)	93,053,994	[9] 249,705,903	105,988,514	[9] 279,178,751	99,462,850	[9] 269,016,546
Pig ...short tons	55,223,641	1,111,811,316	59,100,601	1,227,389,689	60,787,159	1,273,634,210
Lead (refined),[6] sales value ...do	470,517	53,639,000	467,367	[7] 58,888,000	401,071	[7] 51,337,000
Magnesium (new ingot) ...do	15,528	7,454,282	47,420	21,216,414	170,267	69,960,921
Manganese ore (35 percent or more Mn) ...do	87,794	2,696,124	(4 5)	(4 5)	(4 5)	(4 5) [illegible]3,073
Manganiferous ore (5 to 35 percent Mn) ...do	1,430,887	3,700,716	(4 5)	(4 5)	(4 5)	[illegible] 611,495
Mercury:						2,844,000
Metal ...flasks (76 pounds net)	44,921	8,311,283	50,846	9,983,612	51,929	43,878,266
Ore ...short tons	(10)	(11)	(10)	(11)	(10)	
Molybdenum ...pounds	38,200,000	25,883,000	(4 5)	(4 5)	(4 5) [illegible]31	7,376,566
Nickel ...short tons	660	(12)	(4 5)	(4 5)	(4 5) [illegible]92,000	145,416,000
Ores (crude), old tailings, etc.:					99,445	346,558
Copper ...do	78,453,000	(11)	92,664,000	(11)	468,860	4,870,237
Dry and siliceous (gold and silver) ...do	17,639,000	(11)	11,649,000	(11)	331,901	4,097,635
Lead ...do	6,151,000	(11)	7,612,000	(11) [illegible]19	171,343,250	184,320,034
Lead-copper ...do	6,000	(11)	1,000	(11) [illegible],000	2,953,845	47,300,000
Zinc ...do	10,492,000	(11)	9,119,000	[illegible],253,104	1,195,707	10,270,009
Zinc-copper ...do	81,000	(11)	7,000	4,754,076	412,868	5,121,414
Zinc-lead ...do	16,211,000	(11)	18,827,000	272,428	14,912	244,365
Zinc-lead-copper ...do	1,000	(11)	2,000			
Platinum metals (refined) (value at New York City) ...troy ounces	22,683	837,000	(4 5)			

See footnotes at end of table.

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Mineral products of the Unitea

Product	1941					
	Quantity	Val.				
METALLIC—continued						
Selenium .... pounds	681, 650	(12)				
Silver [13] .... troy ounces	72, 336, 029	[illegible]				
Tantalum and columbium ores .... pounds	250	[illegible]				
Tellurium .... do	239, 983	(12)				
Tin (metallic equivalent) .... short tons	63	65, 600				
Titanium concentrates:						
Ilmenite .... do	21, 526	196, 522				
Rutile .... do	3, 431	493, 782				
Tungsten ore (60 percent concentrates) .... do	6, 567	9, 223, 726				
Vanadium .... pounds	2, 513, 051	1, 179, 500				
Zinc,[6] sales value .... short tons	652, 599	97, 890, 000				
Other metallic [14]	....	2, 031, 953	....			
Total value of metallic products (approximate)	....	2, 132, 000, 000	....			
NONMETALLIC						
Arsenious oxide .... short tons	34, 784	1, 119, 320	(4 15)			
Asbestos .... do	24, 391	725, 753	(4 15)			
Asphalt:						
Native .... do	691, 168	3, 169, 193	[illegible]			
Oil (including road oil)[9] .... do	6, 267, 688	[9] 55, 510, 338	(4 9)			
Barite (crude) .... do	503, 156	3, 134, 234	429, 484			[illegible]
Boron minerals .... do	301, 282	6, 785, 662	226, 723			[illegible]
Bromine .... pounds	68, 317, 019	11, 506, 213	65, 880, 935			[illegible]
Calcium-magnesium chloride (75 percent $CaCl_2$) .... short tons	165, 932	1, 333, 370	224, 527			1, 549, 565
Cement .... barrels (376 pounds net)	170, 365, 440	250, 589, 481	187, 809, 208			202, 460, 328
Clay:						
Products (other than pottery and refractories)	....	[16] 135, 000, 000	....	[illegible]	....	[16] 75, 200, 000
Raw (sold by producers) .... short tons	7, 018, 056	24, 925, 717	7, 342, 843		[illegible]	24, 786, 924
Coal:						
Bituminous [17] .... do	514, 149, 245	1, 125, 362, 836	582, 692, 937	[illegible]	589. 043, 000	1, 568, 597, 000
Pennsylvania anthracite .... do	56, 368, 267	240, 275, 000	60, 327, 729	[illegible]	60, 643, 620	306, 816, 018
Coke [9] .... do	65, 186, 578	[9] 352, 967, 237	70, 568, 944	[illegible]	71, 676, 063	[9] 476, 117, 472
Diatomite .... do	(18)	(18)	(18)	(18)	(18)	(18)
Emery .... do	4, 876	42, 484	5, 277	49, 413	6, 666	63, 195
Feldspar (crude) .... long tons	338, 860	1, 519, 456	316, 166	1, 546, 702	308, 180	1, 646, 277
Fluorspar .... short tons	320, 669	6, 724, 782	360, 316	8, 897, 749	406, 016	11, 802, 255
Fuller's earth .... do	207, 446	2, 111, 674	204, 244	2, 139, 670	271, 667	2, 867, 808
Garnet for abrasive purposes .... do	5, 501	371, 752	4, 357	299, 904	5, 935	429, 120
Gems and precious stones	....	(19)	....	(19)	....	(19)

Graphite:							
Amorphous	short tons	(18)	(18)	7,253	401,690	9,597	908,102
Crystalline	pounds	(18)	(18)				
Grindstones and pulpstones	short tons	15,536	545,556	14,681	539,739	12,623	468,205
Gypsum (crude)	do	4,788,534	6,794,223	4,697,566	6,811,180	3,877,541	5,959,615
Helium [20]	cubic feet	16,173,430	(18)	(18)	(18)	(18)	(18)
Iodine	pounds	(18)	(18)	(18)	(18)	(18)	(18)
Kyanite	short tons	8,335	175,581	8,708	190,750	9,561	238,649
Lime	do	6,079,416	42,941,162	6,103,791	44,367,441	6,596,615	49,064,828
Lithium minerals	do	3,832	115,718	5,406	242,516	8,155	314,660
Magnesite (crude)	do	374,799	2,655,547	497,368	3,874,334	754,832	6,071,596
Magnesium compounds (natural) (including brucite)	pounds	274,714,000	3,587,784	738,514,000	10,727,560	1,226,148,000	21,605,241
Marl:							
Calcareous	short tons	183,009	175,398	194,878	135,046	147,153	152,821
Greensand	do	11,120	619,664	10,110	448,440	10,056	522,124
Mica:							
Scrap	do	32,500	442,789	(4 18)	(4 18)	(4 18)	(4 18)
Sheet	pounds	2,666,453	566,858	(4 18)	(4 18)	(4 18)	(4 18)
Millstones		------	15,579	------	10,391	------	9,240
Mineral pigments:							
Natural pigments and manufactured iron oxide pigments	short tons	(21)	(21)	97,327	7,764,232	100,666	8,029,057
Zinc and lead pigments [22]	do	228,123	27,994,694	156,215	21,255,125	192,827	26,340,947
Mineral waters	gallons sold	(19)	(19)	(19)	(19)	(19)	(19)
Natural gas	M cubic feet	2,812,658,000	621,333,000	3,053,475,000	692,737,000	3,349,586,000	753,810,000
Natural gasoline and allied products:							
Natural gasoline and cycle products	gallons	2,688,714,000	105,815,000	2,725,968,000	102,565,000	2,708,538,000	121,000,000
Liquefied petroleum gases	do	707,196,000	13,305,000	773,556,000	19,000,000	994,980,000	26,000,000
Oilstones, etc	short tons	(18)	(18)	(18)	(18)	(18)	(18)
Olivine	do	4,828	24,401	5,739	45,201	5,415	48,633
Peat	do	86,503	657,556	71,500	516,887	60,002	491,460
Petroleum	barrels (42 gallons)	1,402,228,000	1,602,000,000	1,386,645,000	1,643,470,000	1,503,176,000	1,812,560,000
Phosphate rock	long tons	4,689,652	15,596,273	4.644,240	16,597,492	5,126,232	18,962,021
Potassium salts	short tons	[23] 531,346	17,368,237	[23] 680,831	22,962,518	[23] 732,151	26,183,073
Pumice	do	117,310	669,514	126,522	706,199	85,150	611,495
Pyrites	long tons	645,257	2,009,000	720,363	2,464,000	802,384	2,844,000
Salt (sodium chloride)	short tons	12,720,629	33,620,376	13,693,284	38,144,234	15,214,152	43,878,266
Sand and gravel:							
Glass sand	do	3,475,111	6,113,529	3,622,487	6,784,427	3,971,931	7,376,566
Sand (molding, building, etc.) and gravel	do	285,240,000	141,093,000	300,724,000	181,716,000	230,092,000	145,416,000
Silica (quartz)	do	41,685	228,587	65,878	331,494	99,445	346,558
Slate	do	618,660	7,515,634	590,770	6,360,223	468,860	4,870,237
Sodium salts (carbonates and sulfates) (natural)	do	304,201	3,266,123	325,652	3,815,272	331,901	4,097,635
Stone [24]	do	183,107,960	195,337,426	195,884,490	205,002,019	171,343,250	184,320,034
Sulfur	long tons	3,401,410	54,400,000	3,128,559	50,100,000	2,953,845	47,300,000
Sulfuric acid (60° Baumé) (byproduct) [25]	short tons	915,989	7,201,161	960,764	8,253,104	1,195,707	10,270,009
Talc, pyrophyllite, and ground soapstone [24]	do	416,369	4,701,892	387,963	4,754,076	412,868	5,121,414
Tripoli	do	29,301	421,746	17,536	272,428	14,912	244,365

See footnotes at end of table.

Mineral products of the United States, 1941–43—Continued

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
METALLIC—continued						
Selenium ... pounds	681,650	(12)	316,613	(12)	521,779	(12)
Silver [13] ... troy ounces	72,336,029	$51,438,954	56,090,855	$39,886,830	40,820,639	$29,028,010
Tantalum and columbium ores ... pounds	250	219	(4 5)	(4 5)	(4 5)	(4 5)
Tellurium ... do	239,983	(12)	98,798	(12)	62,260	(12)
Tin (metallic equivalent) ... short tons	63	65,600	(4 5)	(4 5)	(4 5)	(4 5)
Titanium concentrates:						
Ilmenite ... do	21,526	196,522	93,397	1,805,823	211,715	3,738,970
Rutile ... do	3,431	493,782	2,649	410,956	3,911	610,879
Tungsten ore (60 percent concentrates) ... do	6,567	9,223,726	(4 5)	(4 5)	(4 5)	(4 5)
Vanadium ... pounds	2,513,051	1,179,500	(4 5)	(4 5)	(4 5)	(4 5)
Zinc,[6] sales value ... short tons	652,599	97,890,000	629,957	[7] 109,613,000	594,250	[7] 102,211,000
Other metallic [14] ...		2,031,953		3,643,356		3,276,533
Total value of metallic products (approximate) ...		2,132,000,000		2,363,300,000		2,493,000,000
NONMETALLIC						
Arsenious oxide ... short tons	34,784	1,119,320	(4 15)	(4 15)	(4 15)	(4 15)
Asbestos ... do	24,391	725,753	(4 15)	(4 15)	(4 15)	(4 15)
Asphalt:						
Native ... do	691,168	3,169,193	975,373	4,279,442	886,135	4,288,488
Oil (including road oil)[9] ... do	6,267,688	[9] 55,510,338	(4 9)	(4 9)	(4 9)	(4 9)
Barite (crude) ... do	503,156	3,134,234	429,484	2,673,002	420,343	2,796,776
Boron minerals ... do	301,282	6,785,662	226,723	5,733,648	256,633	6,401,507
Bromine ... pounds	68,317,019	11,506,213	65,880,935	13,729,383	94,085,937	19,107,065
Calcium-magnesium chloride (75 percent $CaCl_2$) ... short tons	165,932	1,333,370	224,527	1,733,169	199,796	1,549,565
Cement ... barrels (376 pounds net)	170,365,440	250,589,481	187,809,208	286,905,197	129,478,662	202,460,328
Clay:						
Products (other than pottery and refractories) ...		[16] 135,000,000		[16] 102,740,000		[16] 75,200,000
Raw (sold by producers) ... short tons	7,018,056	24,925,717	7,342,843	24,523,227	7,108,965	24,786,924
Coal:						
Bituminous [17] ... do	514,149,245	1,125,362,836	582,692,937	1,373,990,608	589,043,000	1,568,597,000
Pennsylvania anthracite ... do	56,368,267	240,275,000	60,327,729	271,673,000	60,643,620	306,816,018
Coke [9] ... do	65,186,578	[9] 352,967,237	70,568,944	[9] 425,613,744	71,676,063	[9] 476,117,472
Diatomite ... do	(18)	(18)	(18)	(18)	(18)	(18)
Emery ... do	4,876	42,484	6,277	49,413	6,666	63,195
Feldspar (crude) ... long tons	338,860	1,519,456	316,166	1,546,702	308,180	1,646,277
Fluorspar ... short tons	320,669	6,724,782	360,316	8,897,749	406,016	11,802,255
Fuller's earth ... do	207,446	2,111,674	204,244	2,139,670	271,667	2,867,808
Garnet for abrasive purposes ... do	5,501	371,752	4,357	299,904	5,935	429,120
Gems and precious stones ...		(19)		(19)		(19)

Graphite:						
Amorphous .... short tons	(18)	(18)	7,253	401,690	9,597	908,102
Crystalline .... pounds	(18)	(18)				
Grindstones and pulpstones .... short tons	15,536	545,556	14,681	539,739	12,623	488,205
Gypsum (crude) .... do	4,788,534	6,794,223	4,697,568	6,811,180	3,877,541	5,959,615
Helium [20] .... cubic feet	16,173,430	(18)	(18)	(18)	(18)	(18)
Iodine .... pounds	(18)	(18)	(18)	(18)	(18)	(18)
Kyanite .... short tons	8,335	175,581	8,708	190,750	9,561	288,649
Lime .... do	6,079,416	42,941,162	6,103,791	44,867,441	6,596,615	49,064,828
Lithium minerals .... do	3,832	115,718	5,405	242,516	8,155	314,660
Magnesite (crude) .... do	374,799	2,655,547	497,368	3,874,334	754,832	6,071,596
Magnesium compounds (natural) (including brucite) .... pounds	274,714,000	3,587,784	738,514,000	10,727,560	1,226,148,000	21,605,241
Marl:						
Calcareous .... short tons	183,009	175,398	194,878	135,046	147,153	152,821
Greensand .... do	11,120	619,664	10,110	448,440	10,056	522,124
Mica:						
Scrap .... do	32,500	442,789	(4 18)	(4 18)	(4 18)	(4 18)
Sheet .... pounds	2,666,453	566,858	(4 18)	(4 18)	(4 18)	(4 18)
Millstones	--------	15,579	--------	10,391	--------	9,240
Mineral pigments:						
Natural pigments and manufactured iron oxide pigments short tons	(21)	(21)	97,327	7,764,232	100,666	8,029,057
Zinc and lead pigments [22] .... do	228,123	27,994,694	156,215	21,255,125	192,827	26,340,947
Mineral waters .... gallons sold	(19)	(19)	(19)	(19)	(19)	(19)
Natural gas .... M cubic feet	2,812,658,000	621,333,000	3,053,475,000	692,737,000	3,349,586,000	753,810,000
Natural gasoline and allied products:						
Natural gasoline and cycle products .... gallons	2,688,714,000	105,815,000	2,725,968,000	102,565,000	2,708,538,000	121,000,000
Liquefied petroleum gases .... do	707,196,000	18,305,000	773,556,000	19,000,000	994,980,000	26,000,000
Oilstones, etc .... short tons	(18)	(18)	(18)	(18)	(18)	(18)
Olivine .... do	4,828	24,401	5,739	45,201	5,415	48,633
Peat .... do	86,503	657,556	71,500	516,887	60,002	491,460
Petroleum .... barrels (42 gallons)	1,402,228,000	1,602,000,000	1,386,645,000	1,643,470,000	1,503,176,000	1,812,560,000
Phosphate rock .... long tons	4,689,652	15,596,273	4,644,240	16,597,492	5,126,232	18,962,021
Potassium salts .... short tons	[23] 531,346	17,368,237	[23] 680,831	22,962,518	[23] 732,151	26,183,073
Pumice .... do	117,310	669,514	126,522	706,199	85,150	611,495
Pyrites .... long tons	645,257	2,009,000	720,363	2,464,000	802,384	2,844,000
Salt (sodium chloride) .... short tons	12,720,629	33,620,376	13,693,284	38,144,234	15,214,152	43,878,266
Sand and gravel:						
Glass sand .... do	3,475,111	6,113,529	3,622,487	6,784,427	3,971,931	7,376,566
Sand (molding, building, etc.) and gravel .... do	285,240,000	141,093,000	300,724,000	181,716,000	230,092,000	145,416,000
Silica (quartz) .... do	41,685	228,587	65,878	331,494	99,445	346,558
Slate .... do	618,660	7,515,634	590,770	6,360,223	468,860	4,870,237
Sodium salts (carbonates and sulfates) (natural) .... do	304,201	3,266,123	325,652	3,815,272	331,901	4,097,635
Stone [24] .... do	183,107,960	195,837,426	195,884,490	205,002,019	171,343,250	184,820,034
Sulfur .... long tons	3,401,410	54,400,000	3,128,559	50,100,000	2,953,845	47,800,000
Sulfuric acid (60° Baumé) (byproduct) [25] .... short tons	915,989	7,201,161	960,764	8,253,104	1,195,707	10,270,009
Talc, pyrophyllite, and ground soapstone [24] .... do	416,369	4,701,892	387,963	4,754,076	412,868	5,121,414
Tripoli .... do	29,301	421,746	17,536	272,428	14,912	244,365

See footnotes at end of table.

Mineral products of the United States, 1941–43—Continued

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
NONMETALLIC—continued						
Vermiculite short tons	23, 438	$125, 444	57, 848	$319, 931	46, 615	$471, 595
Other nonmetallic [26]		4, 466, 325		4, 265, 893		4, 770, 156
Total value of nonmetallic products (approximate)		4, 746, 000, 000		5, 212, 400, 000		5, 563, 000, 000
SUMMARY						
Total value:						
Metallic		2, 132, 000, 000		2, 363, 300, 000		2, 493, 000, 000
Nonmetallic:						
Fuels		3, 708, 100, 000		4, 103, 400, 000		4, 589, 000, 000
Other		1, 037, 900, 000		1, 109, 000, 000		974, 000, 000
Grand total approximate value of mineral products		6, 878, 000, 000		7, 575, 700, 000		8, 056, 000, 000

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[1] In this general statement certain of the figures represent shipments rather than quantity mined, and some of the figures for 1943 are subject to revision. For details see following chapters of this volume.

[2] Figures represent antimonial lead produced at primary refineries from both domestic and foreign primary and secondary sources; no figures for value of antimonial lead available. Estimate of value of primary antimony and lead contents of antimonial lead from domestic sources included in total value of metallic products.

[3] Largely from foreign ore; value not included in total value.

[4] Figures withheld from publication in accordance with censorship regulations.

[5] Value included in total value of metallic products.

[6] Product from domestic ores only.

[7] Value does not include premiums paid to miners by the Government. Total premiums for copper, lead, and zinc amounted to approximately $26,000,000 in 1942 and $68,000,000 in 1943.

[8] According to Bureau of the Mint. Valued at $35 per ounce.

[9] Value not included in total value.

[10] Figures not available.

[11] Figures showing values not available.

[12] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.

[13] According to Bureau of the Mint.

[14] Includes value of following products. Figures are shown wherever Bureau of Mines is at liberty to publish them.

1941: Bismuth, cobalt, indium, iron ore sold for paint (20,792 long tons, $101,710), radium, thallium, uranium compounds, and zircon (174 short tons, $5,153).

1942: Bismuth, cobalt, germanium, indium, radium, thallium, and zircon.

1943: Bismuth, cobalt, germanium, indium, thallium, and zircon.

[15] Value included in total value of nonmetallic products.

[16] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[17] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.

[18] Value included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[19] No canvass. Estimate of value included in total value of nonmetallic products.

[20] Figures cover fiscal year ended June 30 of year stated.

[21] Canvass discontinued after 1915. Figures for iron ore sold for paint given in footnote 14.

[22] Sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

[23] Equivalent as K_2O.

[24] Figures for soapstone used as dimension stone included in figures for stone.

[25] From copper, lead, and zinc smelters and zinc roasters.

[26] Includes value of following products. Figures are shown wherever Bureau of Mines is at liberty to publish them.

1941: Andalusite, crude aplite, natural sulfonated bitumen, chats (5,291,491 short tons, $897,940), dumortierite, flint lining for tube mills (3,411 short tons, $54,216), pebbles for grinding (13,561 short tons, $221,826), silica sand and sandstone (ground) (487,665 short tons, $3,073,730), strontium minerals (4,724 short tons, $69,054), sulfur ore (409 long tons, $2,553), and industrial topaz.

1942: Andalusite, crude aplite, natural sulfonated bitumen, dumortierite, flint lining for tube mills (2,576 short tons, $49,967), pebbles for grinding (15,487 short tons, $245,794), silica sand and sandstone (ground) (527,886 short tons, $3,646,643), strontium minerals (4,041 short tons, $55,529), sulfur ore (1,590 long tons, $16,000), and industrial topaz.

1943: Andalusite, crude aplite, natural sulfonated bitumen, calcite (Iceland spar), corundum, dumortierite, flint lining for tube mills (2,585 short tons, $46,071), pebbles for grinding (9,924 short tons, $157,778), quartz crystal, silica sand and sandstone (ground) (541,350 short tons, $3,937,452), strontium minerals (7,566 short tons, $114,526), sulfur ore (2,572 long tons, $26,215), industrial topaz, and wollastonite.

Value of mineral products of the United States, 1880–1943 [1]

Year	Metallic	Nonmetallic			Grand total
		Fuels [2]	Other	Total	
1880 [1]	$190,881,000	$120,241,000	$56,341,000	$176,582,000	$367,463,000
1881	192,663,000	149,798,000	60,659,000	210,457,000	403,120,000
1882	219,070,000	170,479,000	63,557,000	234,036,000	453,106,000
1883	201,131,000	185,760,000	61,170,000	246,930,000	448,061,000
1884	182,784,000	165,825,000	58,431,000	224,256,000	407,040,000
1885	174,718,000	183,075,000	61,758,000	244,833,000	419,551,000
1886	204,795,000	184,608,000	66,782,000	251,390,000	456,185,000
1887	241,183,000	217,251,000	77,199,000	294,450,000	535,633,000
1888	242,460,000	231,459,000	79,880,000	311,339,000	553,799,000
1889	250,823,000	208,297,000	83,206,000	291,503,000	542,326,000
1890	303,937,000	230,962,000	80,530,000	311,492,000	615,429,000
1891	280,985,000	237,160,000	82,704,000	319,864,000	600,849,000
1892	284,215,000	248,344,000	89,673,000	338,017,000	622,232,000
1893	223,654,000	251,735,000	70,104,000	321,839,000	545,493,000
1894	187,335,000	235,618,000	127,292,000	362,910,000	550,245,000
1895	248,533,000	268,438,000	125,720,000	394,158,000	642,691,000
1896	252,575,000	268,161,000	120,305,000	388,466,000	641,041,000
1897	270,434,000	253,598,000	127,580,000	381,178,000	651,612,000
1898	308,747,000	267,513,000	150,782,000	418,295,000	727,042,000
1899	484,021,000	340,773,000	185,302,000	526,075,000	1,010,096,000
1900	514,232,000	406,376,000	188,328,000	594,704,000	1,108,936,000
1901	493,814,000	442,409,000	218,855,000	661,264,000	1,155,078,000
1902	605,017,000	469,079,000	253,855,000	722,934,000	1,327,951,000
1903	589,253,000	634,226,000	271,902,000	906,128,000	1,495,381,000
1904	501,314,000	584,043,000	273,824,000	857,867,000	1,359,181,000
1905	702,785,000	602,258,000	318,722,000	920,980,000	1,623,765,000
1906	886,280,000	652,398,000	362,202,000	1,014,600,000	1,900,880,000
1907	904,151,000	789,128,000	376,291,000	1,165,419,000	2,069,570,000
1908	550,890,000	716,034,000	324,849,000	1,040,883,000	1,591,773,000
1909	755,092,000	746,204,000	385,811,000	1,132,015,000	1,887,107,000
1910	750,027,000	828,213,000	409,604,000	1,237,817,000	1,987,844,000
1911	681,023,000	835,763,000	407,295,000	1,243,058,000	1,924,081,000
1912	862,191,000	945,541,000	430,062,000	1,375,603,000	2,237,794,000
1913	879,058,000	1,087,843,000	466,644,000	1,554,487,000	2,433,545,000
1914	687,101,000	992,837,000	431,234,000	1,424,071,000	2,111,172,000
1915	993,353,000	972,617,000	428,674,000	1,401,291,000	2,394,644,000
1916	1,622,129,000	1,332,584,000	553,726,000	1,886,310,000	3,508,439,000
1917	2,088,914,000	2,237,837,000	665,745,000	2,903,582,000	4,992,496,000
1918	2,156,588,000	2,736,151,000	647,969,000	3,384,120,000	5,540,708,000
1919	1,361,099,000	2,510,894,000	751,777,000	3,262,671,000	4,623,770,000
1920	1,763,675,000	4,192,910,000	1,024,755,000	5,217,665,000	6,981,340,000
1921	654,700,000	2,703,470,000	780,330,000	3,483,800,000	4,138,500,000
1922	988,100,000	2,737,880,000	921,310,000	3,659,190,000	4,647,290,000
1923	1,511,930,000	3,317,100,000	1,157,470,000	4,474,570,000	5,986,500,000
1924	1,233,370,000	2,898,630,000	1,173,800,000	4,072,430,000	5,306,800,000
1925	1,382,155,000	3,058,680,000	1,236,795,000	4,295,475,000	5,677,630,000
1926	1,405,345,000	3,541,916,000	1,266,339,000	4,808,255,000	6,213,600,000
1927	1,220,633,000	3,060,047,000	1,249,320,000	4,309,367,000	5,530,000,000
1928	1,288,290,000	2,884,962,000	1,211,948,000	4,096,910,000	5,385,200,000
1929	1,480,390,000	3,190,527,000	1,216,683,000	4,407,210,000	5,887,600,000
1930	985,790,000	2,764,500,000	1,014,510,000	3,779,010,000	4,764,800,000
1931	569,790,000	1,892,400,000	704,410,000	2,596,810,000	3,166,600,000
1932	285,875,000	1,743,400,000	432,425,000	2,175,825,000	2,461,700,000
1933	417,065,000	1,683,400,000	454,635,000	2,138,035,000	2,555,100,000
1934	548,934,000	2,233,300,000	543,166,000	2,776,466,000	3,325,400,000
1935	733,130,000	2,330,000,000	586,870,000	2,916,870,000	3,650,000,000
1936	1,081,600,000	2,759,200,000	716,000,000	3,475,200,000	4,556,800,000
1937	1,468,200,000	3,200,500,000	744,700,000	3,945,200,000	5,413,400,000
1938	892,600,000	2,820,300,000	650,300,000	3,470,600,000	4,363,200,000
1939	1,291,700,000	2,834,300,000	788,200,000	3,622,500,000	4,914,200,000
1940	1,678,600,000	3,116,500,000	818,800,000	3,935,300,000	5,613,900,000
1941	2,132,000,000	3,708,100,000	1,037,900,000	4,746,000,000	6,878,000,000
1942	2,363,300,000	4,103,400,000	1,109,000,000	5,212,400,000	7,575,700,000
1943 [3]	2,493,000,000	4,589,000,000	974,000,000	5,563,000,000	8,056,000,000
Grand total	53,399,427,000	96,305,952,000	31,810,010,000	128,115,962,000	181,515,389,000

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[1] Figures for earlier years not available.

[2] Coal, natural gas, natural gasoline and allied products, petroleum.

[3] Subject to revision.

The sum of the following State totals does not reach the total for the United States given in the preceding table partly because figures for certain of the products included in the United States total are not available by States of origin. This fact is brought out in the opening text of this chapter and in the second table following.

In addition, there are many factors (the more important discussed in the opening text) that account for the disagreement between the sum of the State totals and the grand total for the United States, by products. Chief among these are: (1) The use of iron ore values in State totals and pig iron values in United States total; (2) the use of mine figures for gold, silver, copper, lead, and zinc in the State totals and mint and smelter figures (supplemented by the value of byproduct sulfuric acid from copper, lead, and zinc smelting and zinc roasting and the value of zinc and lead pigments made in large part direct from ores) in the United States total; and (3) the inclusion of estimates in the United States total for a few products for which no canvass has been conducted for many years and for which no estimate by States is made.

Many other less important differences are involved, but both State and United States totals are as complete and definite as seems possible with the data available. The practice is consistent from year to year, and it is believed that the reader can determine readily just what minerals are covered by the total concerned.

In every table each mineral produced is listed, and all figures are shown except those that the Bureau of Mines is not at liberty to publish.

Value of mineral products of the United States, 1939–43, and total, 1911–43, by States [1]

State	1939	1940	1941	1942	1943	1911–43 [1]		
						Total value	Rank	Percent of total for United States
Alabama	$52, 158, 173	$64, 998, 018	$82, 730, 210	$100, 222, 752	$102, 013, 000	$1, 882, 442, 000	20	1. 43
Alaska	25, 673, 566	28, 724, 221	26, 809, 380	20, 094, 260	9, 326, 000	709, 922, 000	30	. 54
Arizona	75, 087, 930	85, 291, 347	100, 472, 791	117, 990, 899	124, 574, 000	3, 013, 616, 000	12	2. 28
Arkansas	29, 572, 632	37, 479, 135	47, 081, 326	60, 337, 118	80, 864, 000	1, 017, 655, 000	27	. 77
California	467, 612, 196	455, 672, 038	506, 795, 395	541, 391, 606	569, 386, 000	11, 338, 652, 000	3	8. 58
Colorado	64, 144, 557	63, 188, 421	73, 960, 602	95, 278, 822	87, 924, 000	1, 972, 597, 000	19	1. 49
Connecticut	4, 306, 351	3, 914, 177	5, 284, 955	5, 054, 812	4, 835, 000	152, 836, 000	41	. 12
Delaware	401, 333	457, 326	492, 631	402, 273	367, 000	13, 146, 000	50	. 01
District of Columbia	591, 837	640, 480	700, 000	600, 000	100, 000	19, 615, 000	49	. 01
Florida	13, 060, 453	14, 854, 206	19, 268, 779	20, 303, 948	25, 070, 000	429, 670, 000	34	. 33
Georgia	14, 633, 655	16, 932, 335	21, 049, 261	22, 008, 807	20, 997, 000	391, 440, 000	36	. 30
Idaho	33, 138, 452	40, 799, 920	45, 673, 740	54, 289, 536	57, 475, 000	990, 178, 000	29	. 75
Illinois	210, 798, 331	277, 943, 011	320, 509, 559	327, 665, 438	318, 270, 000	6, 294, 726, 000	6	4. 77
Indiana	53, 884, 995	58, 975, 110	80, 572, 397	89, 571, 417	82, 632, 000	2, 460, 957, 000	15	1. 86
Iowa	25, 170, 181	26, 006, 904	28, 872, 177	28, 278, 387	24, 027, 000	1, 006, 258, 000	28	. 76
Kansas	122, 959, 513	130, 859, 896	171, 991, 685	201, 454, 022	220, 438, 000	3, 550, 302, 000	10	2. 69
Kentucky	112, 840, 566	131, 974, 410	169, 009, 195	204, 294, 168	226, 597, 000	3, 578, 923, 000	9	2. 71
Louisiana	168, 903, 151	189, 153, 312	228, 440, 044	246, 438, 691	267, 617, 000	2, 986, 014, 000	13	2. 26
Maine	3, 769, 791	4, 374, 976	4, 692, 448	3, 614, 054	2, 720, 000	146, 195, 000	42	. 11
Maryland	11, 781, 531	12, 605, 171	17, 291, 523	18, 383, 872	17, 095, 000	498, 565, 000	33	. 38
Massachusetts	8, 242, 956	7, 573, 122	9, 293, 169	8, 467, 398	5, 441, 000	319, 811, 000	37	. 24
Michigan	116, 088, 154	124, 774, 581	142, 433, 673	161, 433, 922	156, 875, 000	3, 592, 679, 000	8	2. 72
Minnesota	106, 455, 607	128, 571, 690	178, 790, 274	191, 649, 723	177, 687, 000	3, 487, 879, 000	11	2. 64
Mississippi	5, 192, 156	7, 239, 647	17, 750, 726	29, 992, 924	21, 148, 000	141, 906, 000	43	. 11
Missouri	45, 633, 707	50, 324, 566	61, 545, 052	76, 122, 304	70, 945, 000	2, 089, 054, 000	18	1. 58
Montana	63, 343, 802	79, 487, 873	86, 583, 460	96, 681, 604	91, 633, 000	2, 355, 310, 000	17	1. 78
Nebraska	4, 390, 291	4, 692, 146	6, 499, 070	8, 428, 200	6, 830, 000	131, 789, 000	44	. 10
Nevada	34, 670, 879	42, 570, 529	46, 341, 010	46, 207, 961	56, 312, 000	1, 040, 720, 000	26	. 79
New Hampshire	1, 187, 339	1, 065, 337	1, 382, 506	1, 211, 184	1, 350, 000	70, 578, 000	47	. 05
New Jersey	30, 441, 758	33, 653, 732	39, 074, 518	38, 921, 351	37, 583, 000	1, 559, 408, 000	21	1. 18
New Mexico	69, 987, 797	80, 969, 723	97, 849, 086	106, 811, 195	124, 392, 000	1, 311, 803, 000	23	. 99
New York	78, 409, 560	76, 119, 505	91, 582, 704	103, 298, 336	87, 942, 000	2, 381, 768, 000	16	1. 80
North Carolina	18, 533, 720	21, 112, 732	18, 915, 461	17, 372, 690	22, 172, 000	297, 386, 000	39	. 23
North Dakota	2, 689, 627	2, 987, 351	3, 327, 627	4, 028, 008	4, 557, 000	84, 510, 000	46	. 06
Ohio	120, 681, 969	130, 655, 129	164, 826, 884	175, 548, 629	186, 366, 000	5, 750, 569, 000	7	4. 35
Oklahoma	236, 194, 064	235, 535, 062	263, 763, 923	271, 298, 469	253, 284, 000	9, 543, 416, 000	5	7. 23
Oregon	8, 637, 047	11, 229, 670	12, 830, 176	14, 065, 572	12, 310, 000	205, 600, 000	40	. 16

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. Comparable totals for years before 1911 not available.

The sum of the following State totals does not reach the total for the United States given in the preceding table partly because figures for certain of the products included in the United States total are not available by States of origin. This fact is brought out in the opening text of this chapter and in the second table following.

In addition, there are many factors (the more important discussed in the opening text) that account for the disagreement between the sum of the State totals and the grand total for the United States, by products. Chief among these are: (1) The use of iron ore values in State totals and pig iron values in United States total; (2) the use of mine figures for gold, silver, copper, lead, and zinc in the State totals and mint and smelter figures (supplemented by the value of byproduct sulfuric acid from copper, lead, and zinc smelting and zinc roasting and the value of zinc and lead pigments made in large part direct from ores) in the United States total; and (3) the inclusion of estimates in the United States total for a few products for which no canvass has been conducted for many years and for which no estimate by States is made.

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In every table each mineral produced is listed, and all figures are shown except those that the Bureau of Mines is not at liberty to publish.

Value of mineral products of the United States, 1939–43, and total, 1911–43, by States [1]

State	1939	1940	1941	1942	1943	1911–43 [1]		
						Total value	Rank	Percent of total for United States
Alabama	$52, 158, 173	$64, 998, 018	$82, 730, 210	$100, 222, 752	$102, 013, 000	$1, 882, 442, 000	20	1. 43
Alaska	25, 673, 566	28, 724, 221	26, 809, 380	20, 094, 260	9, 326, 000	709, 922, 000	30	. 54
Arizona	75, 087, 930	85, 291, 347	100, 472, 791	117, 990, 899	124, 574, 000	3, 013, 616, 000	12	2. 28
Arkansas	29, 572, 632	37, 479, 135	47, 081, 326	60, 337, 118	80, 864, 000	1, 017, 655, 000	27	. 77
California	467, 612, 196	455, 672, 038	506, 795, 395	541, 391, 606	569, 386, 000	11, 338, 652, 000	3	8. 58
Colorado	64, 144, 557	63, 188, 421	73, 960, 602	95, 278, 822	87, 924, 000	1, 972, 597, 000	19	1. 49
Connecticut	4, 306, 351	3, 914, 177	5, 284, 955	5, 054, 812	4, 835, 000	152, 836, 000	41	. 12
Delaware	401, 333	457, 326	492, 631	402, 273	367, 000	13, 146, 000	50	. 01
District of Columbia	591, 837	640, 480	700, 000	600, 000	100, 000	19, 615, 000	49	. 01
Florida	13, 060, 453	14, 854, 206	19, 268, 779	20, 303, 948	25, 070, 000	429, 670, 000	34	. 33
Georgia	14, 633, 655	16, 932, 335	21, 049, 261	22, 008, 807	20, 997, 000	391, 440, 000	36	. 30
Idaho	33, 138, 452	40, 799, 920	45, 673, 740	54, 289, 536	57, 475, 000	990, 178, 000	29	. 75
Illinois	210, 798, 331	277, 943, 011	320, 509, 559	327, 665, 438	318, 270, 000	6, 294, 726, 000	6	4. 77
Indiana	53, 884, 995	58, 975, 110	80, 572, 397	89, 571, 417	82, 632, 000	2, 460, 957, 000	15	1. 86
Iowa	25, 170, 181	26, 006, 904	28, 872, 177	28, 278, 387	24, 027, 000	1, 006, 258, 000	28	. 76
Kansas	122, 959, 513	130, 859, 896	171, 991, 685	201, 454, 022	220, 438, 000	3, 550, 302, 000	10	2. 69
Kentucky	112, 840, 566	131, 974, 410	169, 009, 195	204, 294, 168	226, 597, 000	3, 578, 923, 000	9	2. 71
Louisiana	168, 903, 151	189, 153, 312	228, 440, 044	246, 438, 691	267, 617, 000	2, 986, 014, 000	13	2. 26
Maine	3, 769, 791	4, 374, 976	4, 692, 448	3, 614, 054	2, 720, 000	146, 195, 000	42	. 11
Maryland	11, 781, 531	12, 605, 171	17, 291, 523	18, 383, 872	17, 096, 000	498, 565, 000	33	. 38
Massachusetts	8, 242, 956	7, 573, 122	9, 298, 169	8, 467, 398	5, 441, 000	319, 811, 000	37	. 24
Michigan	116, 068, 154	124, 774, 581	142, 433, 673	161, 433, 922	156, 875, 000	3, 592, 679, 000	8	2. 72
Minnesota	106, 455, 607	128, 571, 690	178, 790, 274	191, 649, 723	177, 687, 000	3, 487, 879, 000	11	2. 64
Mississippi	5, 192, 156	7, 239, 647	17, 760, 726	29, 992, 924	21, 148, 000	141, 906, 000	43	. 11
Missouri	45, 633, 707	50, 324, 566	61, 545, 052	76, 122, 304	70, 945, 000	2, 089, 054, 000	18	1. 58
Montana	63, 343, 802	79, 487, 873	86, 583, 460	96, 681, 604	91, 633, 000	2, 355, 310, 000	17	1. 78
Nebraska	4, 390, 291	4, 692, 146	6, 499, 070	8, 428, 200	6, 830, 000	131, 789, 000	44	. 10
Nevada	34, 670, 879	42, 570, 529	46, 341, 010	46, 207, 961	56, 312, 000	1, 040, 720, 000	26	. 79
New Hampshire	1, 187, 339	1, 065, 337	1, 382, 506	1, 211, 184	1, 350, 000	70, 578, 000	47	. 05
New Jersey	30, 441, 758	33, 653, 732	39, 074, 518	38, 921, 351	37, 583, 000	1, 559, 408, 000	21	1. 18
New Mexico	69, 987, 797	80, 969, 723	97, 849, 086	106, 811, 195	124, 392, 000	1, 311, 803, 000	23	. 99
New York	78, 409, 560	76, 119, 505	91, 582, 704	103, 298, 336	87, 942, 000	2, 381, 768, 000	16	1. 80
North Carolina	18, 533, 720	21, 112, 732	18, 915, 461	17, 372, 690	22, 172, 000	297, 386, 000	39	. 23
North Dakota	2, 689, 627	2, 987, 351	3, 327, 627	4, 028, 008	4, 557, 000	84, 510, 000	46	. 06
Ohio	120, 681, 969	130, 655, 129	164, 826, 884	175, 548, 629	186, 366, 000	5, 750, 569, 000	7	4. 35
Oklahoma	236, 194, 064	235, 535, 062	263, 763, 923	271, 298, 469	253, 284, 000	9, 543, 416, 000	5	7. 23
Oregon	8, 637, 047	11, 229, 670	12, 830, 176	14, 065, 572	12, 310, 000	205, 600, 000	40	. 16

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. Comparable totals for years before 1911 not available.

Value of mineral products of the United States, 1939–43, and total, 1911–43, by States—Continued

State	1939	1940	1941	1942	1943	1911–43		
						Total value	Rank	Percent of total for United States
Pennsylvania	$531,007,890	$618,347,805	$737,143,530	$841,847,147	$889,156,000	$24,093,468,000	1	18.24
Rhode Island	980,916	994,997	1,133,400	836,040	808,000	29,769,000	48	.02
South Carolina	5,422,979	5,305,597	7,245,613	5,890,982	4,759,000	99,144,000	45	.08
South Dakota	24,813,621	23,528,825	24,501,696	24,139,283	8,611,000	413,539,000	35	.31
Tennessee	39,818,234	42,683,407	56,301,592	67,223,639	65,053,000	1,145,548,000	25	.87
Texas	701,972,035	725,005,009	868,082,690	909,203,286	1,116,056,000	13,002,741,000	2	9.84
Utah	80,127,521	104,392,989	122,386,873	147,073,924	160,935,000	2,557,096,000	14	1.94
Vermont	6,972,234	6,979,772	8,131,670	7,266,089	6,404,000	316,265,000	38	.24
Virginia	43,902,881	50,003,672	71,340,934	79,770,810	82,068,000	1,239,597,000	24	.94
Washington	31,595,704	28,090,188	28,506,882	35,659,543	37,547,000	679,800,000	31	.51
West Virginia	276,084,118	329,891,960	425,626,303	493,994,630	560,330,000	9,728,600,000	4	7.37
Wisconsin	12,704,942	13,553,683	17,020,722	17,998,036	18,925,000	526,816,000	32	.40
Wyoming	39,413,001	43,073,533	52,751,354	64,070,497	68,664,000	1,427,004,000	22	1.08

Mineral products of the United States and principal producing States in 1942

Rank in value	Product	Principal producing States[1]	
		In order of quantity	In order of value
12	Aluminum	Tennessee, Washington, New York, North Carolina	Rank same as for quantity.
94	Andalusite	California	Do.
(2)	Antimonial lead	Not separable by States	Not separable by States.
68	Antimony ore	Idaho, Nevada, Montana, California	Rank same as for quantity.
82	Aplite (crude)	Virginia	Do.
60	Arsenious oxide	Montana, Utah, Nevada	Do.
67	Asbestos	Vermont, Arizona, North Carolina, Georgia	Vermont, Arizona, North Carolina, California.
	Asphalt:		
44	Native	Texas, Oklahoma, Kentucky, Alabama	Oklahoma, Utah, Texas, Kentucky.
17	Oil	Not separable by States	Not separable by States.
51	Barite (crude)	Missouri, Georgia, Tennessee, Arkansas	Missouri, Tennessee, Georgia, Arkansas.
31	Bauxite	Arkansas, Alabama, Georgia, Virginia	Rank same as for quantity.
93	Beryllium ore	South Dakota, Maine, New Hampshire, Colorado	Do.
50	Bismuth	Not separable by States	Not separable by States.
96	Bitumen (natural sulfonated)	Utah	Rank same as for quantity.
41	Boron minerals	California	Do.
29	Bromine	Texas, North Carolina, Michigan, California	Texas, Michigan, North Carolina, California.
40	Cadmium	Not separable by States	Not separable by States.
56	Calcium-magnesium chloride	Michigan, West Virginia, California, Ohio	Rank same as for quantity.
6	Cement	Pennsylvania, California, Texas, New York	Do.
49	Chromite	Montana, California, Oregon, Washington	California, Montana, Oregon, Washington.
	Clay:		
16	Products (other than pottery and refractories).		Ohio, Pennsylvania, California, Illinois.
24	Raw (sold by producers)	Pennsylvania, Missouri, Ohio, Georgia	Georgia, Pennsylvania, Missouri, Kentucky.
1	Coal:		
	Bituminous	West Virginia, Pennsylvania, Illinois, Kentucky	West Virginia, Pennsylvania, Kentucky, Illinois.
	Pennsylvania anthracite	Pennsylvania	Rank same as for quantity.
72	Cobalt	Pennsylvania, Nevada	Do.
5	Coke	Pennsylvania, Ohio, Indiana, Alabama	Pennsylvania, Ohio, Indiana, New York.
9	Copper	Arizona, Utah, Montana, Nevada	Rank same as for quantity.
48	Diatomite	California, Oregon, Nevada, Washington	Do.
101	Dumortierite	Nevada	Do.
90	Emery	New York	Do.
58	Feldspar (crude)	North Carolina, South Dakota, New Hampshire, Colorado	North Carolina, New Hampshire, South Dakota, Virginia.
8	Ferro-alloys	Pennsylvania, New York, Ohio, West Virginia	Pennsylvania, New York, West Virginia, Tennessee.
89	Flint lining for tube mills	Minnesota, North Carolina, Wisconsin	Rank same as for quantity.
34	Fluorspar	Illinois, Kentucky, Colorado, New Mexico	Do.
54	Fuller's earth	Texas, Georgia, Florida, Illinois	Do.
76	Garnet (abrasive)	New York, North Carolina, Idaho	Do.
(3)	Gems and precious stones	No canvass for 1942	No canvass for 1942.
102	Germanium	Not separable by States	Not separable by States.
13	Gold	California, South Dakota, Alaska, Utah	Rank same as for quantity.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1942—Continued

Rank in value	Product	Principal producing States[1]	
		In order of quantity	In order of value
71	Graphite:		
	Amorphous	Rhode Island	Rank same as for quantity.
	Crystalline	New York, Texas, Alabama	Do.
65	Grindstones and pulpstones	Ohio, West Virginia, Washington	Do.
37	Gypsum (crude)	New York, Michigan, Iowa, California	Do.
84	Helium	Texas	Do.
81	Indium	Not separable by States	Not separable by States.
63	Iodine (natural)	California	Rank same as for quantity.
	Iron:		
7	Ore	Minnesota, Michigan, Alabama, Wisconsin	Minnesota, Michigan, Alabama, New York.
3	Pig	Pennsylvania, Ohio, Indiana, Illinois	Rank same as for quantity.
83	Kyanite	Virginia, California, Georgia, North Carolina	Virginia, North Carolina, Georgia, California.
18	Lead	Missouri, Idaho, Utah, Oklahoma	Rank same as for quantity.
21	Lime	Ohio, Pennsylvania, Missouri, West Virginia	Do.
79	Lithium minerals	South Dakota, California, Maine, North Carolina	Do.
45	Magnesite (crude)	Washington, Nevada, California, Texas	Washington, California, Nevada, Texas.
27	Magnesium	Texas, Michigan, Ohio, California	Rank same as for quantity.
32	Magnesium compounds (natural)	Texas, Michigan, Nevada, California	Texas, Michigan, California, Nevada.
38	Manganese ore	Montana, California, Virginia, Washington	Montana, Washington, California, Virginia.
42	Manganiferous ore	Minnesota, New Mexico, Michigan, Montana	Minnesota, New Mexico, Montana, Michigan.
62	Manganiferous zinc residuum	New Jersey	Rank same as for quantity.
	Marl:		
85	Calcareous	Minnesota, Michigan, Virginia, Indiana	Michigan, Virginia, Minnesota, West Virginia.
69	Greensand	New Jersey	Rank same as for quantity.
33	Mercury	California, Oregon, Nevada, Idaho	Do.
59	Mica	North Carolina, California, Colorado, Georgia	North Carolina, South Dakota, Georgia, New Hampshire.
	Scrap	do	North Carolina, South Dakota, Colorado, California.
	Sheet	North Carolina, South Dakota, New Hampshire, Connecticut	North Carolina, South Dakota, New Hampshire, Georgia.
97	Millstones		North Carolina, Virginia, New York.
	Mineral pigments:		
36	Natural pigments and manufactured iron oxide pigments.	Pennsylvania, Illinois, Virginia, New Jersey	Pennsylvania, New Jersey, Illinois, California.
26	Lead and zinc pigments	Pennsylvania, Illinois, Kansas, Ohio	Rank same as for quantity.
(3)	Mineral waters	No canvass for 1942	No canvass for 1942.
20	Molybdenum	Colorado, Utah, New Mexico, Arizona	Rank same as for quantity.
4	Natural gas	Texas, Louisiana, California, Oklahoma	Texas, California, West Virginia, Louisiana.
14	Natural gasoline and allied products:		
	Natural gasoline and cycle products	Texas, California, Oklahoma, Louisiana	Rank same as for quantity.
	Liquefied petroleum gases	Texas, Oklahoma, California, Illinois	Do.
73	Nickel	Not separable by States	Not separable by States.
80	Oilstones, etc	Arkansas, Ohio, New Hampshire, Indiana	Rank same as for quantity.
92	Olivine	North Carolina	Do.

(4)	Ores (crude), etc.:		
	Copper	Utah, Arizona, Nevada, New Mexico	Value not available.
	Dry and siliceous (gold and silver)	Alaska, California, South Dakota, Nevada	Do.
	Lead	Missouri, Idaho, Utah, Nevada	Do.
	Lead-copper	New Mexico, Arizona, Idaho, Utah	Do.
	Zinc	Oklahoma, Kansas, Tennessee, Missouri	Do.
	Zinc-copper	Arizona	Do.
	Zinc-lead	Oklahoma, Kansas, Idaho, Missouri	Do.
	Zinc-lead-copper	Utah	Do.
66	Peat	Illinois, New York, Michigan, New Jersey	Maine, Illinois, Michigan, Iowa.
78	Pebbles for grinding	Texas, North Carolina, Minnesota, Wisconsin	Rank same as for quantity.
2	Petroleum	Texas, California, Oklahoma, Louisiana	Texas, California, Oklahoma, Illinois.
28	Phosphate rock	Florida, Tennessee, Montana, Idaho	Rank same as for quantity.
57	Platinum metals	Alaska, California, Oregon	Do.
25	Potassium salts	New Mexico, California, Utah, Maryland	Do.
64	Pumice	California, Kansas, New Mexico, Nebraska	New Mexico, California, Kansas, Nebraska.
53	Pyrites	Tennessee, California, Virginia, New York	Rank same as for quantity.
87	Radium	Not separable by States	Not separable by States.
23	Salt	Michigan, New York, Ohio, Louisiana	Michigan, New York, Ohio, Kansas.
11	Sand and gravel	California, Texas, Illinois, New York	California, New York, Texas, Illinois.
61	Selenium	Not separable by States	Not separable by States.
74	Silica (quartz)	California, Wisconsin, North Carolina, Tennessee	North Carolina, California, Tennessee, Maryland.
47	Silica sand and sandstone (ground)	Illinois, New Jersey, Ohio, Pennsylvania	Rank same as for quantity.
22	Silver	Idaho, Montana, Utah, Arizona	Do.
39	Slate		Pennsylvania, Vermont, New York, Maine.
46	Sodium salts (carbonates and sulfates) (natural).	California, Texas, Wyoming, Washington	Rank same as for quantity.
10	Stone	Pennsylvania, Michigan, Ohio, Illinois	Pennsylvania, Ohio, Illinois, New York.
88	Strontium minerals	California, Texas, Washington	Rank same as for quantity.
19	Sulfur	Texas, Louisiana, California, Utah	Do.
35	Sulfuric acid from copper, lead, and zinc smelters and zinc roasters.	Pennsylvania, Illinois, Arizona, Tennessee	Do.
95	Sulfur ore	Texas, Colorado	Do.
43	Talc, pyrophyllite, and ground soapstone [5]	New York, Vermont, North Carolina, California	New York, California, Vermont, North Carolina.
103	Tantalum and columbium ores	South Dakota	Rank same as for quantity.
86	Tellurium	Not separable by States	Not separable by States.
91	Thallium	do	Do.
99	Tin	Alaska, South Dakota, New Mexico, California, and Nevada	Alaska, South Dakota, New Mexico, and California and Nevada.
	Titanium concentrates:		
55	Ilmenite	Virginia, New York, North Carolina, Florida	New York, Virginia, North Carolina, Florida.
70	Rutile	Virginia, Florida, Arkansas	Rank same as for quantity.
98	Topaz (industrial)	South Carolina	Do.
77	Tripoli	Illinois, Missouri, Arkansas, Pennsylvania	Do.
30	Tungsten ore	California, Nevada, Idaho, Colorado	Do.
52	Vanadium	Colorado, Utah, Idaho, Arizona	Do.
75	Vermiculite	Montana, Colorado, North Carolina, Wyoming	Do.
15	Zinc	Oklahoma, New Jersey, Idaho, Kansas	Do.
100	Zircon	Florida	Do.

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[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output. Compilation of rank for 1943 not yet available.

[2] Separate figures for antimonial lead from primary sources not available.

[3] No canvass for 1942.

[4] Value not available.

[5] Exclusive of soapstone used as dimension stone (all from Virginia), which is included in figures for stone.

States and their principal mineral products in 1942 [1]

State	Rank	Percent of total value for United States	Principal mineral products in order of value
Alabama	17	1.62	Coal, iron ore, cement, stone.
Alaska	35	.32	Gold, coal, platinum metals, sand and gravel.
Arizona	14	1.90	Copper, gold, silver, zinc.
Arkansas	25	.97	Petroleum, bauxite, coal, sand and gravel.
California	3	8.73	Petroleum, natural gas, cement, gold.
Colorado	19	1.54	Molybdenum, coal, gold, zinc.
Connecticut	44	.08	Stone, sand and gravel, clay products, magnesium.
Delaware	50	.01	Clay products, sand and gravel, stone, raw clay.
District of Columbia	49	.01	Clay products.
Florida	34	.33	Phosphate rock, stone, cement, sand and gravel.
Georgia	33	.35	Stone, raw clay, cement, clay products.
Idaho	26	.88	Zinc, lead, silver, gold.
Illinois	5	5.28	Petroleum, coal, stone, sand and gravel.
Indiana	20	1.44	Coal, cement, petroleum, stone.
Iowa	31	.46	Cement, coal, stone, clay products.
Kansas	9	3.25	Petroleum, natural gas, cement, zinc.
Kentucky	8	3.29	Coal, natural gas, petroleum, stone.
Louisiana	7	3.97	Petroleum, natural gas, natural gasoline, sulfur.
Maine	46	.06	Cement, sand and gravel, stone, slate.
Maryland	36	.30	Sand and gravel, coal, cement, stone.
Massachusetts	40	.14	Stone, sand and gravel, clay products, lime.
Michigan	12	2.60	Iron ore, petroleum, cement, salt.
Minnesota	10	3.09	Iron ore, manganiferous ore, sand and gravel, cement.
Mississippi	30	.48	Petroleum, sand and gravel, clay products, natural gas.
Missouri	22	1.23	Lead, cement, coal, stone.
Montana	18	1.56	Copper, zinc, petroleum, natural gas.
Nebraska	41	.14	Sand and gravel, cement, petroleum, stone.
Nevada	27	.74	Copper, gold, tungsten ore, silver.
New Hampshire	47	.02	Stone, clay products, feldspar, sand and gravel.
New Jersey	28	.63	Zinc, sand and gravel, clay products, stone.
New Mexico	15	1.72	Petroleum, potassium salts, copper, natural gas.
New York	16	1.67	Cement, petroleum, sand and gravel, stone.
North Carolina	38	.28	Bromine, clay products, stone, sand and gravel.
North Dakota	45	.06	Coal, sand and gravel, clay products, natural gas.
Ohio	11	2.83	Coal, natural gas, clay products, stone.
Oklahoma	6	4.37	Petroleum, natural gas, zinc, natural gasoline.
Oregon	39	.23	Sand and gravel, cement, stone, gold.
Pennsylvania	2	13.57	Coal, petroleum, cement, natural gas.
Rhode Island	48	.01	Sand and gravel, stone, graphite, clay products.
South Carolina	43	.09	Stone, clay products, raw clay, sand and gravel.
South Dakota	32	.39	Gold, stone, sand and gravel, cement.
Tennessee	23	1.08	Coal, cement, stone, zinc.
Texas	1	14.65	Petroleum, natural gas, natural gasoline, sulfur.
Utah	13	2.37	Copper, coal, gold, lead.
Vermont	42	.12	Stone, slate, talc, lime.
Virginia	21	1.29	Coal, stone, sand and gravel, cement.
Washington	29	.57	Cement, coal, sand and gravel, magnesite.
West Virginia	4	7.96	Coal, natural gas, petroleum, natural gasoline.
Wisconsin	37	.29	Stone, iron ore, sand and gravel, zinc.
Wyoming	24	1.03	Petroleum, coal, natural gas, iron ore.

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. Compilation of rank for 1943 not yet available.

Prices of gold, silver, copper, lead, and zinc, 1932–43 [1]

Year	Gold [2]	Silver [3]	Copper [4]	Lead [4]	Zinc [4]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1932	[5] $20.67+	$0.282	$0.063	$0.030	$0.030
1933	25.56	.350	.064	.037	.042
1934	34.95	[6] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065
1938	35.00	[6] .646+	.098	.046	.048
1939	35.00	[7] .678+	.104	.047	.052
1940	35.00	[8] .711+	.113	.050	.063
1941	35.00	[8] .711+	.118	.057	.075
1942	35.00	[8] .711+	.121	.067	.093
1943	35.00	[8] .711+	.130	.075	.108

[1] Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ per fine ounce. For table of prices for silver, copper, lead, and zinc from 1850 to 1931, by years, see Mineral Resources, 1931, pt. 1, p. A115.

[2] 1932: Legal coinage value; 1933–34: Yearly average weighted Government price; 1935–43: Price under authority of Gold Reserve Act of January 31, 1934.

[3] 1932–33: Average New York price for bar silver; 1934 and 1938–43: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.

[4] Yearly average weighted price of all grades of primary metal sold by producers. In 1942 and 1943, price includes premiums paid to miners by the Government.

[5] $20.671835. [6] $0.64646464. [7] $0.67878787. [8] $0.71111111.

STATE TABLES

Mineral products of the United States, 1941–43, by States

ALABAMA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminum	short tons	6,091	[1] $1,938,653	(1 2)	(1 2)	(1 2)	(1 2)
Asphalt (native)	do	(2)	(2)	(2)	(2)	(2)	(2)
Barite	do	----------	----------	(2)	(2)	----------	----------
Bauxite	do	(2)	(2)	(2)	(2)	(2)	(2)
Cement	barrels	[3] 7,610,030	[3] 11,142,649	[3] 8,598,332	[3] $12,874,701	[3] 7,368,567	[3] $10,943,926
Clay:							
Products (other than pottery and refractories)		----------	[4] 2,647,000	----------	[4] 2,000,000	----------	[4] 1,500,000
Raw (sold by producers)	short tons	179,023	186,476	194,452	219,563	185,442	259,899
Coal	do	15,464,523	41,985,942	19,301,254	55,408,117	17,750,000	58,575,000
Coke	do	4,855,062	[1] 18,628,534	5,674,939	[1] 26,950,850	5,351,129	[1] 28,006,359
Ferro-alloys	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Gold	troy ounces	30	1,050	1	35	----------	----------
Graphite, crystalline	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Iron:							
Ore	long tons	7,873,228	18,090,992	8,845,146	19,034,753	8,060,473	21,047,231
Pig	short tons	3,712,018	[1] 64,037,109	4,083,330	[1] 70,638,989	3,811,987	[1] 66,151,938
Lime	do	306,836	1,705,558	330,552	1,916,985	331,182	1,959,266
Manganese ore	do	185	2,736	(2)	(2)	----------	----------
Manganiferous ore	do	----------	----------	(2)	(2)	----------	----------
Mica:							
Scrap	do	(2)	(2)	(2)	(2)	(2)	(2)
Sheet	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Ore (dry and siliceous) (gold and silver)	short tons	1,020	(6)	35	(6)	----------	----------
Pebbles for grinding	do	----------	----------	(2)	(2)	----------	----------
Quartz crystal	pounds	----------	----------	----------	----------	(2)	(2)
Sand and gravel	short tons	2,428,995	1,556,457	4,659,624	2,538,738	3,704,777	2,629,186
Silver	troy ounces	3	2	----------	----------	----------	----------
Stone	short tons	2,804,740	3,745,651	3,141,300	3,738,902	2,568,520	3,178,908
Talc	do	----------	----------	(2)	(2)	----------	----------
Tin (metallic equivalent)	do	3	3,020	(2)	(2)	----------	----------
Miscellaneous [7]		----------	6,524,117	----------	20,814,117	----------	26,791,542
Total value, eliminating duplications		----------	82,730,210	----------	100,222,752	----------	102,013,000

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[1] Value not included in total value for State.

[2] Value included under "Miscellaneous."

[3] Exclusive of puzzolan, value for which is included under "Miscellaneous."

[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metals.

[7] Includes minerals indicated by "2" and "3" above.

Mineral products of the United States, 1941–43, by States—Continued

ALASKA

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore (concentrates)……short tons	(1)	(1)	(1)	(1)	(1)	(1)
Arsenic……do	(2)	(2)	(2)	(2)	(2)	(2)
Chromite……do					(1)	(1)
Coal……do	238, 960	$944, 588	260, 893	$1, 623, 264	300, 000	$2, 130, 000
Copper……pounds	144, 000	16, 992	44, 000	5, 324	54, 000	7, 020
Gold……troy ounces	695, 467	24, 341, 345	487, 621	17, 066, 735	99, 583	3, 485, 405
Lead……short tons	662	75, 468	415	55, 610	200	30, 000
Mercury……flasks (76 pounds)	(1)	(1)	(1)	(1)	786	153, 435
Ores (crude), etc.:						
Copper……short tons	144	(3)			8	(3)
Dry and siliceous (gold and silver)……do	4, 480, 364	(3)	2, 816, 668	(3)	1, 483, 519	(3)
Platinum metals (crude)……troy ounces	24, 800	1, 078, 000	(1)	(1)	(1)	(1)
Sand and gravel……short tons	[4] 530, 997	[4] 87, 116	(1)	(1)	(1)	(1)
Silver……troy ounces	191, 522	136, 193	119, 704	85, 123	42, 788	30, 427
Stone……short tons					(1)	(1)
Tin (metallic equivalent)……do	52	(1)	(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates)……do			(1)	(1)		
Miscellaneous [5]		129, 678		1, 258, 204		3, 489, 498
Total value, eliminating duplications		26, 809, 380		20, 094, 260		9, 326, 000

[1] Value included under "Miscellaneous."

[2] Figures not available.

[3] Not valued as ore; value of recoverable metal content included under the metals.

[4] "Government-and-contractor." Value of "Commercial" included under "Miscellaneous."

[5] Includes minerals indicated by "1" and "4" above.

ARIZONA

Product	1941 Quantity	1941 Value	1942 Quantity	1942 Value	1943 Quantity	1943 Value
Antimony ore (concentrates)……short tons	(1)	(1)				
Arsenious oxide……do	(2)	(2)	(2)	(2)	(2)	(2)
Asbestos……do	2, 574	$166, 027	(3)	(3)	(3)	(3)
Barite……do					(3)	(3)
Bismuth……pounds	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products (other than pottery and refractories)		[4] 284, 000		[4] $210, 000		[4] $200, 060
Raw (sold by producers)……short tons	(3)	(3)	(3)	(3)	(3)	(3)
Coal……do	(3)	(3)	11, 373	30, 068	(3)	(3)
Copper……pounds	652, 634, 000	77, 010, 812	786, 774, 000	95, 199, 654	806, 362, 000	104, 827, 060
Feldspar (crude)……long tons	(3)	(3)	(3)	(3)	(3)	(3)
Fluorspar……short tons	(3)	(3)	(3)	(3)	1, 328	26, 441

Gems and precious stones		-----	(5)	-----	(5)	-----	(5)
Gold	troy ounces	315,392	11,038,720	253,651	8,877,785	171,810	6,013,350
Gypsum (crude)	short tons	-----	-----	(9)	(9)	-----	-----
Iron ore	long tons	-----	-----	345	(3)	261	(3)
Lead	short tons	15,638	1,782,732	14,772	1,979,448	13,727	2,059,050
Lime	do	58,146	413,095	59,033	439,817	71,044	556,345
Manganese ore	do	1,012	17,441	(3)	(3)	(3)	(3)
Manganiferous ore	do	17	(3)	-----	-----	(3)	(3)
Mercury	flasks (76 pounds)	873	161,522	701	137,641	541	105,609
Mica:							
Scrap	short tons	180	900	-----	-----	-----	-----
Sheet	pounds	-----	-----	-----	-----	(3)	(3)
Molybdenum	do	(3)	(3)	(3)	(3)	(3)	(3)
Ores (crude), etc.:							
Copper	short tons	24,153,483	(6)	32,856,971	(6)	36,022,080	(6)
Dry and siliceous (gold and silver)	do	975,790	(6)	657,942	(6)	186,185	(6)
Lead	do	18,432	(6)	25,898	(6)	41,006	(6)
Lead-copper	do	663	(6)	473	(6)	182	(6)
Zinc	do	2,143	(6)	106,400	(6)	3,083	(6)
Zinc-copper	do	80,810	(6)	7,267	(6)	88,883	(6)
Zinc-lead	do	260,473	(6)	265,780	(6)	262,630	(6)
Zinc-lead-copper	do	-----	-----	-----	-----	26,739	(6)
Quartz crystal	pounds	-----	-----	-----	-----	(3)	(3)
Sand and gravel	short tons	702,889	335,474	1,611,353	1,193,603	855,671	649,006
Silica (quartz)	do	(3)	(3)	(3)	(3)	(3)	(3)
Silver	troy ounces	7,498,260	5,332,096	7,064,467	5,023,621	5,713,889	4,063,210
Stone	short tons	455,900	340,872	227,220	219,231	340,200	317,454
Sulfuric acid [7]	do	(3 8)	(3 8)	(3 8)	(3 8)	(3 8)	(3 8)
Tungsten ore (60-percent concentrates)	do	277	(3)	(3)	(3)	(3)	(3)
Vanadium	pounds	(3)	(3)	(3)	(3)	(3)	(3)
Zinc	short tons	16,493	2,473,950	18,522	3,445,092	19,677	4,250,232
Miscellaneous [9]		-----	1,734,029	-----	1,925,934	-----	2,081,392
Total value, eliminating duplications		-----	100,472,791	-----	117,990,899	-----	124,574,000

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[1] Less than 1 ton; value not recorded.
[2] Figures not available.
[3] Value included under "Miscellaneous."
[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] From copper smelting.
[8] Value not included in total value for State.
[9] Includes minerals indicated by "9" above.

Mineral products of the United States, 1941–43, by States—Continued

ARKANSAS

Product	1941 Quantity	1941 Value	1942 Quantity	1942 Value	1943 Quantity	1943 Value
Aluminum short tons			(1 2)	(1 2)	(1 2)	(1 2)
Barite do	(1)	(1)	(1)	(1)	(1)	(1)
Bauxite do	911, 170	$4, 952, 839	2, 767, 315	$12, 029, 406	7, 264, 748	$31, 448, 573
Cement barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[3] 1, 110, 000		[3] 800, 000		[3] 500, 000
Raw (sold by producers) short tons	15, 249	14, 487	(1)	(1)	(1)	(1)
Coal do	1, 574, 172	5, 882, 934	1, 985, 393	7, 551, 232	2, 038, 000	8, 315, 000
Gems and precious stones		(4)		(4)		(4)
Gypsum (crude) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore long tons					144	(1)
Lead short tons	11	1, 254	2	268	1	150
Lime do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore do	5, 015	113, 125	(1)	(1)	(1)	(1)
Manganiferous ore do	3, 381	44, 890	(1)	(1)	(1)	(1)
Mercury flasks (76 pounds)	2, 012	372, 260	2, 392	469, 669	1, 532	299, 062
Mineral waters gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas M cubic feet	19, 148, 000	2, 988, 000	19, 456, 000	3, 027, 000	26, 000, 000	3, 900, 000
Natural gasoline and allied products:						
Natural gasoline gallons	28, 108, 000	1, 173, 000	34, 033, 000	1, 138, 000	39, 737, 000	1, 550, 000
Liquefied petroleum gases do	6, 281, 000	57, 000	8, 644, 000	92, 000	16, 244, 000	179, 000
Oilstones and whetstones short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ores (crude), etc.:						
Lead do	100	(5)	10	(5)	1	(5)
Zinc do	1, 800	(5)	4, 578	(5)	4, 341	(5)
Zinc-lead do	1, 100	(5)	7	(5)		
Petroleum barrels	26, 327, 000	24, 500, 000	26, 628, 000	26, 300, 000	27, 600, 000	27, 300, 000
Quartz crystal pounds					(1)	(1)
Sand and gravel short tons	3, 587, 906	1, 798, 307	5, 831, 867	3, 919, 212	[6] 2, 648, 986	[6] 1, 715, 704
Slate		(1)		(1)		(1)
Stone short tons	[7] 1, 788, 470	[7] 1, 763, 196	2, 033, 410	2, 152, 956	1, 492, 410	1, 568, 883
Strontium minerals do					(1)	(1)
Titanium concentrates: Rutile do	(1)	(1)	(1)	(1)	(1)	(1)
Tripoli do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc do	206	30, 900	181	33, 666	96	20, 736
Miscellaneous [8]		2, 279, 134		5, 830, 709		23, 151, 539
Total value, eliminating duplications		47, 081, 326		60. 337, 118		80, 864. 000

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[1] Value included under "Miscellaneous."

[2] Value not included in total value for State.

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[7] Exclusive of crushed marble, value for which is included under "Miscellaneous."

[8] Includes minerals indicated by "1," "4," and "7" above.

CALIFORNIA

Aluminum	short tons	---	---	(1 2)	(1 2)	(1 2)	(1 2)
Andalusite	do	(1)	(1)	(1)	(1)	(1)	(1)
Antimony ore (concentrates)	do	51	$1,300	(1)	(1)	---	---
Arsenious oxide	do	(3)	(3)	(3)	(3)	(3)	(3)
Asbestos	do	(1)	(1)	(1)	(1)	(1)	(1)
Asphalt (native)	do	(1)	(1)	(1)	(1)	(1)	(1)
Barite	do	(1)	(1)	(1)	(1)	(1)	(1)
Boron minerals	do	301,282	6,785,662	226,723	$5,733,648	256,633	$6,401,507
Bromine	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Calcite (Iceland spar)	do	---	---	---	---	(1)	(1)
Calcium chloride	short tons	(1)	(1)	5,949	89,487	7,502	110,264
Cement	barrels	20,186,028	28,019,494	23,787,808	36,895,916	17,806,731	27,517,926
Chromite	short tons	13,419	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)		---	[4] 8,649,000	---	[4] 8,500,000	---	[4] 4,000,000
Raw (sold by producers)	short tons	530,140	1,422,511	579,251	1,513,962	579,618	1,535,672
Coke	do	---	---	---	---	317,847	(1 2)
Copper	pounds	7,886,000	930,548	2,116,000	256,036	17,524,000	2,278,120
Diatomite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Feldspar (crude)	long tons	4,464	22,490	5,090	23,261	(1)	(1)
Ferro-alloys	short tons	---	---	---	---	(1 2)	(1 2)
Fluorspar	do	---	---	---	---	134	(1)
Fuller's earth	do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		---	(5)	---	(5)	---	(5)
Gold	troy ounces	1,408,793	49,307,755	847,997	29,679,895	148,328	5,191,480
Gypsum (crude)	short tons	381,951	618,685	426,670	662,181	455,580	622,575
Iodine	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Iron:							
Ore	long tons	53,531	(1)	92,875	239,429	728,810	1,981,400
Pig	short tons	---	---	---	---	(1 2)	(1 2)
Kyanite	do	(1)	(1)	(1)	(1)	(1)	(1)
Lead	do	3,464	394,896	5,151	690,234	5,820	873,000
Lime	do	122,375	1,168,767	83,399	905,923	168,502	1,749,668
Lithium minerals	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium	do	35	17,500	(1)	(1)	(1)	(1)
Magnesium compounds (natural)	pounds	12,810,000	656,297	78,968,525	2,100,588	155,916,000	4,451,499
Manganese ore	short tons	4,096	77,873	(1)	(1)	(1)	(1)
Manganiferous ore	do	464	(1)	(1)	(1)	(1)	(1)
Mercury	flasks (76 pounds)	25,714	4,757,604	29,906	5,872,043	33,812	6,600,440
Mica, scrap	short tons	460	2,300	(1)	(1)	(1)	(1)
Mineral paints (zinc and lead pigments)	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Molybdenum	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas	M cubic feet	374,905,000	96,673,000	403,968,000	110,004,000	450,000,000	119,250,000
Natural gasoline and allied products:							
Natural gasoline	gallons	577,127,000	24,067,000	545,881,000	22,365,000	583,181,000	23,910,000
Liquefied petroleum gases	do	82,638,000	2,082,000	87,445,000	2,564,000	110,139,000	3,524,000

See footnotes at end of table, page 50.

Mineral products of the United States, 1941–43, by States—Continued

CALIFORNIA—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Ores (crude), etc.:							
Copper	short tons	292,232	(6)	393,944	(6)	265,526	(6)
Dry and siliceous (gold and silver)	do	3,968,283	(6)	2,076,551	(6)	412,793	(6)
Lead	do	18,338	(6)	29,857	(6)	49,038	(6)
Lead-copper	do	2	(6)	5	(6)		
Zinc	do	1,330	(6)	2,089	(6)	8,428	(6)
Zinc-copper	do					3,435	(6)
Zinc-lead	do			752	(6)	736	(6)
Peat	do	3,618	$17,898	3,031	$17,262	3,677	$21,365
Pebbles for grinding	do	574	2,856	(1)	(1)	(1)	(1)
Petroleum	barrels	230,263,000	239,500,000	248,326,000	255,800,000	284,235,000	301,300,000
Platinum metals (crude)	troy ounces	1,300	(1)	(1)	(1)	(1)	(1)
Potassium salts	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Pumice	do	77,951	268,734	74,925	206,424	25,490	160,441
Pyrites	long tons	(1)	(1)	(1)	(1)	(1)	(1)
Quartz crystal	pounds					(1)	(1)
Salt (sodium chloride)	short tons	484,632	2,290,265	546,320	2,494,485	596,015	2,839,560
Sand and gravel	do	[7] 19,617,609	[7] 10,988,766	34,791,974	22,067,004	29,025,759	18,548,747
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	2,526	36,721	(1)	(1)	(1)	(1)
Silver	troy ounces	2,154,188	1,531,867	1,450,440	1,031,424	609,075	433,120
Slate			53,765		(1)		(1)
Sodium salts (carbonates and sulfates) (natural)	short tons	218,903	2,224,084	241,386	2,712,438	257,426	3,146,738
Stone	do	[8] 9,139,390	[8] 7,535,017	[8] 12,288,700	[8] 11,031,326	8,231,250	6,595,799
Strontium minerals	do	(1)	(1)	(1)	(1)	(1)	(1)
Sulfur	long tons	8,803	139,800	(1)	(1)		
Sulfuric acid [9]	short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Talc and ground soapstone	do	59,203	811,793	51,649	678,906	58,003	912,291
Tin (metallic equivalent)	do			(1)	(1)	(1)	(1)
Tripoli	do	(1)	(1)				
Tungsten ore (60-percent concentrates)	do	2,603	3,665,194	(1)	(1)	(1)	(1)
Vermiculite	do			(1)	(1)		
Zinc	do	440	66,000	613	114,018	1,856	400,896
Zircon	do	30	545				
Miscellaneous [10]			12,185,888		19,630,115		52,064,500
Total value, eliminating duplications			506,795,395		541,391,606		569,386,000

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[1] Value included under "Miscellaneous."

[2] Value not included in total value for State.

[3] Figures not available.

[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metals.

[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[8] Exclusive of dimension unclassified stone in 1941 and of dimension marble in 1942, value for which is included under "Miscellaneous."

[9] From lead smelting.

[10] Includes minerals indicated by "1," "7," and "8" above.

COLORADO

Arsenious oxide	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite	do	(2)	(2)				
Beryllium ore	do	--------	--------	(2)	(2)	(2)	(2)
Bismuth	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	(2)	(2)	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)		--------	[3] $1,864,000	--------	[3] $1,400,000	--------	[3] $700,000
Raw (sold by producers)	short tons	164,444	226,644	133,758	240,824	101,893	176,067
Coal	do	6,948,532	19,654,459	8,085,680	23,163,270	8,250,000	26,978,000
Coke	do	703,003	(2 4)	763,656	(2 4)	757,643	(2 4)
Copper	pounds	13,496,000	1,592,528	2,204,000	266,684	2,056,000	267,280
Feldspar (crude)	long tons	42,326	147,640	33,610	135,569	20,659	88,691
Ferro-alloys	short tons	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)
Fluorspar	do	15,566	225,069	31,743	640,938	49,145	1,164,868
Fuller's earth	do	--------	--------	(2)	(2)	--------	--------
Gems and precious stones		--------	(5)	--------	(5)	--------	(5)
Gold	troy ounces	380,029	13,301,015	268,627	9,401,945	137,558	4,814,530
Gypsum (crude)	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Iron:							
Ore	long tons	--------	--------	--------	--------	39	(2)
Pig	short tons	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)	(2 4)
Lead	do	12,574	1,433,436	15,181	2,034,254	18,032	2,704,800
Lime	do	(2)	(2)	(2)	(2)	(2)	(2)
Manganese ore	do	190	(2)	(2)	(2)	(2)	(2)
Manganiferous ore	do	--------	--------	(2)	(2)	--------	--------
Mica:							
Scrap	do	(2)	(2)	(2)	(2)	(2)	(2)
Sheet	pounds	(2)	(2)	--------	--------	(2)	(2)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Molybdenum	pounds	24,942,003	(2)	(2)	(2)	(2)	(2)
Natural gas	M cubic feet	3,256,000	714,000	4,865,000	1,066,000	6,300,000	1,385,000
Natural gasoline	gallons	390,000	18,000	346,000	17,000	174,000	9,000
Nickel	short tons	35	(2)	--------	--------	--------	--------
Ores (crude), etc.:							
Copper	do	207,678	(6)	208	(6)	3,008	(6)
Dry and siliceous (gold and silver)	do	1,572,763	(6)	1,212,986	(6)	994,826	(6)
Lead	do	7,917	(6)	6,418	(6)	15,291	(6)
Lead-copper	do	4	(6)	22	(6)	65	(6)
Zinc	do	224	(6)	590	(6)	4,378	(6)
Zinc-lead	do	434,200	(6)	577,162	(6)	613,750	(6)
Peat	do	(2)	(2)	--------	--------	--------	--------
Petroleum	barrels	2,150,000	2,300,000	2,199,000	2,440,000	2,320,000	2,600,000
Pyrites	long tons	11,774	(2)	11,067	31,803	15,215	105,473
Quartz crystal	pounds	--------	--------	--------	--------	(2)	(2)
Salt	short tons	(2)	(2)	(2)	(2)	--------	--------
Sand and gravel	do	[7] 809,270	[7] 528,116	4,631,942	3,220,706	1,575,949	915,664
Silver	troy ounces	7,301,697	5,192,318	3,096,211	2,201,750	2,664,142	1,894,501
Stone	short tons	1,104,820	1,073,400	[8] 951,510	[8] 735,994	880,430	662,804

See footnotes at end of table, page 52.

Mineral products of the United States, 1941–43, by States—Continued

COLORADO—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Sulfur ore	long tons	49	$550	90	$1,000	(2)	(2)
Tantalum and columbium ores	pounds					(2)	(2)
Tungsten ore (60-percent concentrates)	short tons	631	928,508	(2)	(2)	(2)	(2)
Vanadium	pounds	2,168,387	(2)	(2)	(2)	(2)	(2)
Vermiculite	short tons			2,574	25,996	356	$2,529
Zinc	do	15,722	2,358,300	32,215	5,991,990	44,094	9,524,304
Miscellaneous [9]			35,968,568		57,628,888		52,917,175
Total value, eliminating duplications			73,960,602		95,278,822		87,924,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[8] Exclusive of dimension basalt, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "2," "7," and "8" above.

CONNECTICUT

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Clay:							
Products (other than pottery and refractories)			[1] $1,521,000		[1] $1,300,000		[1] $850,000
Raw (sold by producers)	short tons	(2)	(2)	(2)	(2)		
Coke	do	(2 3)	(2 3)	(2 3)	(2 3)	(2 3)	(2 3)
Feldspar (crude)	long tons	13,693	92,397	12,807	92,076	11,618	76,463
Iron ore	do	28	(2)				
Lime	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Magnesium	do			(2)	(2)	(2)	(2)
Mica:							
Scrap	do	201	3,983	(2)	(2)	(2)	(2)
Sheet	pounds	252,825	129,896	(2)	(2)	(2)	(2)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat	short tons	(2)	(2)	(2)	(2)		
Sand and gravel	do	2,076,977	941,902	2,960,477	1,610,583	1,729,052	837,069
Stone	do	[5] 2,244,900	[5] 2,435,841	1,556,350	1,692,399	1,184,950	1,392,215
Miscellaneous [6]			3,722,099		4,628,761		6,153,890
Total value, eliminating duplications			5,284,955		5,054,812		4,835,000

[1] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of crushed granite, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "2" and "5" above.

DELAWARE

Clay:							
Products (other than pottery and refractories)			[1] $225,000		[1] $200,000		[1] $200,000
Raw (sold by producers)	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Sand and gravel	do	168,359	102,854	169,267	95,298	186,923	99,409
Stone	do	109,850	147,212	(2)	(2)	(2)	(2)
Miscellaneous			17,565		106,975		67,461
Total value, eliminating duplications			492,631		402,273		367,000

[1] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[2] Value included under "Miscellaneous."

DISTRICT OF COLUMBIA

Clay products (other than pottery and refractories)		(1 2)		(1 2)		(1 2)
Miscellaneous		$700,000		$600,000		$100,000
Total value, eliminating duplications		700,000		600,000		100,000

[1] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[2] Value included under "Miscellaneous."

FLORIDA

Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $224,000		[2] $170,000		[2] $150,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Diatomite	do	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys	do	(1 3)	(1 3)				
Fuller's earth	do	(1)	(1)	(1)	(1)	(1)	(1)
Lime	do	23,265	216,254	21,510	212,291	20,507	202,276
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum	barrels					4,000	(1)
Phosphate rock	long tons	3,365,572	10,234,031	3,012,240	9,378,577	3,588,493	12,089,477
Sand and gravel	short tons	1,462,276	949,980	[5] 1,834,863	[5] 1,339,361	1,833,453	1,527,985
Stone	do	[6] 4,065,450	[6] 3,852,539	[6] 6,632,680	[6] 5,733,697	[6] 8,741,200	[6] 7,446,388
Titanium concentrates:							
Ilmenite	do	(1)	(1)	(1)	(1)	(1)	(1)
Rutile	do	(1)	(1)	(1)	(1)	(1)	(1)
Zircon	do	144	4,608	(1)	(1)	(1)	(1)
Miscellaneous [7]			3,790,719		3,470,022		3,653,493
Total value, eliminating duplications			19,268,779		20,303,948		25,070,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[6] Exclusive of unclassified stone in 1941 and 1943 and of dimension unclassified stone in 1942, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1," "3," and "4" above.

Mineral products of the United States, 1941–43, by States—Continued

GEORGIA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Asbestos	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite	do	104,446	$553,445	86,636	$483,261	98,680	$621,193
Bauxite	do	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] 2,689,000		[2] 2,000,000		[2] 2,000,000
Raw (sold by producers)	short tons	823,013	6,609,605	803,710	6,190,284	771,862	6,275,935
Coal	do	(1)	(1)	30,913	101,274	38,000	125,000
Fuller's earth	do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones			(3)		(3)		(3)
Gold	troy ounces	311	10,885	30	1,050	12	420
Graphite, crystalline	pounds	(1)	(1)				
Iron ore—							
Shipped to furnaces, etc.	long tons	258,947	598,497	298,370	722,013	413,459	950,211
Sold for paint	do	1,720	4,991				
Kyanite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lime	do	12,515	85,325	10,824	68,323	8,513	59,514
Magnesium sulfate (natural)	pounds					(1)	(1)
Manganese ore	short tons	4,976	108,911	(1)	(1)	(1)	(1)
Manganiferous ore	do	7,907	46,555	(1)	(1)	(1)	(1)
Mica:							
Scrap	do	(1)	(1)	(1)	(1)	(1)	(1)
Sheet	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Ore (dry and siliceous) (gold and silver)	short tons	1,641	(4)	75	(4)		
Peat	do			(1)	(1)	(1)	(1)
Quartz crystal	pounds					(1)	(1)
Sand and gravel	short tons	615,511	283,148	[5] 969,934	[5] 732,528	655,335	467,440
Sand and sandstone (ground)	do			300	3,008	3,252	32,525
Silver	troy ounces	38	27	7	5		
Slate			(1)		(1)		(1)
Stone	short tons	2,808,790	5,809,755	[6] 3,623,160	[6] 6,620,633	2,178,510	5,373,879
Talc	do	28,511	364,560	29,930	464,160	35,210	396,031
Miscellaneous [7]			3,884,557		4,622,268		4,695,156
Total value, eliminating duplications			21,049,261		22,008,807		20,997,000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Not valued as ore; value of recoverable metal content included under the metals.

[5] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1," "4," and "6" above.

IDAHO

Antimony ore (concentrates)	short tons	1,823	$62,000	(1)	(1)	(1)	(1)
Arsenious oxide	do.	(2)	(2)	(2)	(2)	(2)	(2)
Bismuth	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chromite	short tons			(1)	(1)		
Clay:							
Products (other than pottery and refractories)			[3] 122,000		[3] $100,000		[3] $100,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coal	do.	(1)	(1)				
Copper	pounds	7,242,000	854,556	6,860,000	830,060	4,648,000	604,240
Diatomite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Garnet, abrasive	do.	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	149,816	5,243,560	95,020	3,325,700	30,808	1,078,280
Lead	short tons	104,914	11,960,196	113,909	15,263,806	96,457	14,468,550
Lime	do.	120	2,160				
Manganese ore	do.	34	(1)			(1)	(1)
Manganiferous ore	do.	390	2,046				
Mercury	flasks (76 pounds)	(1)	(1)	(1)	(1)	4,261	831,790
Mica:							
Scrap	short tons					(1)	(1)
Sheet	pounds			(1)	(1)	(1)	(1)
Ores (crude), etc.:							
Copper	short tons	7,979	(5)	2,210	(5)	329	(5)
Dry and siliceous (gold and silver)	do.	903,510	(5)	774,874	(5)	531,445	(5)
Lead	do.	212,251	(5)	313,317	(5)	237,122	(5)
Lead-copper	do.	174	(5)	83	(5)	68	(5)
Zinc	do.	22,551	(5)	20,561	(5)	44,382	(5)
Zinc-lead	do.	1,558,215	(5)	1,789,659	(5)	1,928,401	(5)
Phosphate rock	long tons	97,274	444,154	114,079	511,249	108,916	561,630
Quartz crystal	pounds					(1)	(1)
Sand and gravel	short tons	2,846,752	882,867	3,118,581	1,983,054	4,699,745	4,276,960
Silver	troy ounces	16,672,410	11,855,936	14,644,890	10,414,144	11,700,180	8,320,128
Stone	short tons	767,750	644,006	470,590	588,989	91,330	127,092
Tripoli	do.			(1)	(1)		
Tungsten ore (60-percent concentrates)	do.	656	(1)	(1)	(1)	(1)	(1)
Vanadium	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Zinc	short tons	79,084	11,862,600	87,256	16,229,616	86,707	18,728,712
Miscellaneous [6]			1,737,659		5,042,918		8,377,749
Total value, eliminating duplications			45,673,740		54,289,536		57,475,000

[1] Value included under "Miscellaneous."

[2] Figures not available.

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Includes minerals indicated by "1" above.

Mineral products of the United States, 1941–43, by States—Continued

ILLINOIS

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Cement	barrels	[1] 5,958,376	[1] $8,660,104	7,102,393	$10,284,111	4,307,278	$6,657,889
Clay:							
Products (other than pottery and refractories)			[2] 7,977,000		[2] 6,000,000		[2] 4,500,000
Raw (sold by producers)	short tons	276,016	528,136	241,865	397,603	204,860	385,108
Coal	do	54,703,284	98,990,565	65,070,819	124,043,957	72,430,000	152,827,000
Coke	do	3,660,878	[3] 25,214,769	3,690,155	[3] 27,364,122	3,625,457	[3] 29,416,984
Ferro-alloys	do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Fluorspar	do	133,333	3,047,247	161,949	4,306,750	198,789	6,292,789
Fuller's earth	do	26,676	209,577	30,421	264,611	63,909	575,805
Iron, pig	do	5,461,459	[3] 113,558,606	5,871,858	[3] 125,662,134	5,920,894	[3] 126,910,295
Lead	do	2,376	270,864	2,344	314,096	2,043	306,450
Lime	do	246,574	1,702,129	314,078	2,269,743	314,736	2,386,554
Marl, calcareous	do					(4)	(4)
Mineral paints (zinc and lead pigments)	do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas	M cubic feet	10,053,000	1,668,000	14,484,000	2,351,000	16,000,000	2,590,000
Natural gasoline and allied products:							
Natural gasoline	gallons	54,872,000	2,693,000	66,389,000	3,252,000	71,928,000	3,884,000
Liquefied petroleum gases	do	38,293,000	1,054,000	72,934,000	2,000,000	112,159,000	2,580,000
Ores (crude), etc.:							
Lead	short tons					1	(6)
Zinc	do	25	(6)	8	(6)	13,091	(6)
Zinc-lead	do	72,573	(6)	86,788	(6)	84,787	(6)
Peat	do	(4)	(4)	(4)	(4)	(4)	(4)
Petroleum	barrels	132,393,000	172,100,000	106,391,000	144,800,000	82,260,000	111,900,000
Pyrites	long tons	12,026	(4)	13,562	25,063	12,968	23,966
Sand and gravel	short tons	13,888,985	8,271,170	17,720,343	11,532,848	13,722,449	9,882,322
Sand and sandstone (ground)	do	131,581	808,402	158,853	1,087,481	164,401	1,180,469
Silver	troy ounces	20,340	14,464	104	74	2,153	1,531
Stone	short tons	[7] 11,856,340	[7] 10,706,996	14,056,050	12,686,759	11,137,960	10,762,707
Sulfuric acid (60° Baumé) [8]	do	213,749	[3] 1,814,729	215,494	[3] 2,036,418	259,302	[3] 2,481,520
Tripoli	do	13,833	200,700	12,575	203,390	10,203	168,758
Zinc	do	9,198	1,379,700	9,389	1,746,354	5,851	1,263,816
Miscellaneous [9]			5,986,696		5,568,650		4,919,248
Total value, eliminating duplications			320,509,559		327,665,438		318,270,000

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[1] Exclusive of natural cement, value for which is included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] Value included under "Miscellaneous."

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metals.

[7] Exclusive of sandstone, value for which is included under "Miscellaneous."

[8] From zinc smelting.

[9] Includes minerals indicated by "1," "4," and "7" above.

INDIANA

Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $5, 967, 000		[2] $4, 500, 000		[2] $3, 000, 000
Raw (sold by producers)	short tons	217, 913	176, 367	174, 987	127, 962	56, 542	78, 209
Coal	do	22, 483, 929	38, 150, 201	25, 388, 051	45, 282, 626	25, 175, 000	51, 861, 000
Coke	do	7, 406, 724	[3] 48, 432, 824	7, 337, 512	[3] 52, 848, 043	8, 111, 916	[3] 66, 259, 831
Ferro-alloys	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Iron, pig	do	6, 393, 223	[3] 135, 655; 190	6, 446, 750	[3] 142, 920, 764	6, 722, 095	[3] 150, 497, 458
Lime	do	106, 407	588, 879	102, 757	608, 656	(1)	(1)
Marl, calcareous	do	30, 223	17, 815	16, 764	12, 920	9, 904	7, 233
Mineral paints (zinc and lead pigments)	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	1, 522, 000	906, 000	1, 599, 000	888, 000	1, 500, 000	840, 000
Petroleum	barrels	7, 411, 000	9, 400, 000	6, 743, 000	9, 100, 000	5, 283, 000	7, 100, 000
Pyrites	long tons	(1)	(1)	(1)	(1)	3, 906	7, 544
Rubbing stones, scythestones, and whetstones	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	8, 897, 976	4, 560, 652	12, 715, 469	6, 609, 929	8, 062, 568	4, 535, 533
Stone	do	5, 257, 530	6, 742, 744	[5] 6, 460, 540	[5] 7, 007, 241	5, 381, 940	5, 570, 790
Sulfuric acid [6]	do					(1 3)	(1 3)
Miscellaneous [7]			17, 083, 691		20, 914, 175		16, 851, 438
Total value, eliminating duplications			80, 572, 397		89, 571, 417		82, 632, 000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[6] From zinc-roasting operation.

[7] Includes minerals indicated by "1" and "5" above.

IOWA

Cement	**barrels**	**5, 328, 398**	**$8, 659, 014**	**5, 662, 733**	**$9, 151, 499**	**3, 912, 307**	**$6, 335, 173**
Clay:							
Products (other than pottery and refractories)			**[1] 3, 895, 000**		**[1] 2, 900, 000**		**[1] 2, 300, 000**
Raw (sold by producers)	**short tons**	**10, 022**	**50, 700**	**8, 273**	**39, 568**	**7, 120**	**34, 275**
Coal	**do**	**2, 938, 626**	**8, 058, 700**	**2, 947, 722**	**8, 408, 131**	**2, 760, 000**	**8, 418, 000**
Ferro-alloys	**do**	**(2 3)**	**(2 3)**	**(2 3)**	**(2 3)**	**(2 3)**	**(2 3)**
Gypsum (crude)	**do**	**630, 930**	**736, 185**	**514, 587**	**688, 211**	**418, 092**	**595, 602**
Iron, pig	**do**	**(2 3)**	**(2 3)**	**(2 3)**	**(2 3)**		
Mineral waters	**gallons sold**	**(4)**	**(4)**	**(4)**	**(4)**	**(4)**	**(4)**
Peat	**short tons**	**(2)**	**(2)**	**(2)**	**(2)**	**(2)**	**(2)**
Sand and gravel	**do**	**6, 271, 702**	**1, 728, 741**	**6, 700, 745**	**2, 190, 452**	**5, 070, 927**	**1, 979, 559**
Stone	**do**	**5, 790, 920**	**5, 657, 585**	**4, 474, 480**	**4, 849, 803**	**3, 544, 560**	**4, 327, 782**
Miscellaneous [5]			**4, 421, 573**		**5, 635, 297**		**6, 598, 571**
Total value, eliminating duplications			**28, 872, 177**		**28, 278, 387**		**24, 027, 000**

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[1] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[2] Value included under "Miscellaneous."

[3] Value not included in total value for State.

[4] No canvass.

[5] Includes minerals indicated by "2" above.

Mineral products of the United States, 1941-43, by States—Continued

KANSAS

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ....barrels..	[1] 4,734,129	[1] $7,136,933	[1] 7,726,291	[1] $11,415,377	[1] 5,305,798	[1] $8,035,559
Chats ....short tons..	360,951	55,447	(2)	(2)	(2)	(2)
Clay:						
Products (other than pottery and refractories)	----------	[3] 1,121,000	----------	[3] 840,000	----------	[3] 700,000
Raw (sold by producers) ....short tons..	(4)	(4)	(4)	(4)	(4)	(4)
Coal ....do....	4,007,572	7,950,431	4,229,858	9,268,965	4,573,000	11,433,000
Gypsum (crude) ....do....	(4)	(4)	(4)	(4)	(4)	(4)
Lead ....do....	14,538	1,657,332	9,419	1,262,146	9,213	1,381,950
Mineral paints (zinc and lead pigments) ....do....	(4 5)	(4 5)	(4 5)	(4 5)	(4 5)	(4 5)
Mineral waters ....gallons sold..	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ....M cubic feet..	111,121,000	36,552,000	112,921,000	38,354,000	133,000,000	46,550,000
Natural gasoline and allied products:						
Natural gasoline ....gallons..	72,876,000	2,631,000	68,948,000	2,373,000	69,870,000	3,284,000
Liquefied petroleum gases ....do....	12,815,000	410,000	12,880,000	422,000	14,897,000	432,000
Ores (crude), etc.:						
Lead ....short tons..	----------	----------	15	(7)	----------	----------
Zinc ....do....	1,344,123	(7)	1,809,552	(7)	2,232,495	(7)
Zinc-lead ....do....	2,352,124	(7)	2,062,485	(7)	2,243,272	(7)
Petroleum ....barrels..	83,242,000	95,700,000	97,636,000	117,100,000	106,178,000	127,400,000
Pumice ....short tons..	23,659	111,835	36,810	139,930	43,918	163,366
Pyrites ....long tons..	3,902	(4)	----------	----------	----------	----------
Salt ....short tons..	781,014	3,254,828	860,083	3,809,321	945,287	4,197,507
Sand and gravel ....do....	2,927,921	1,288,920	5,201,000	2,773,283	3,615,861	2,103,091
Stone ....do....	2,727,290	3,171,598	[2] 2,588,200	[2] 3,031,049	[2] 2,074,580	[2] 2,291,198
Zinc ....do....	71,403	10,710,450	55,874	10,392,564	56,944	12,299,904
Miscellaneous [8]	----------	3,852,673	----------	2,902,980	----------	2,600,499
Total value, eliminating duplications	----------	171,991,685	----------	201,454,022	----------	220,438,000

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."

[2] After 1941, chats included in figures for stone.

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] Value included under "Miscellaneous."

[5] Value not included in total value for State.

[6] No canvass.

[7] Not valued as ore; value of recoverable metal content included under the metals.

[8] Includes minerals indicated by "1" and "4" above.

KENTUCKY

Product	1941		1942		1943	
Asphalt (native) ....short tons..	(1)	(1)	(1)	(1)	(1)	(1)
Barite ....do....	----------	----------	----------	----------	37	$207
Cement ....barrels..	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	----------	[3] $1,690,000	----------	[3] $1,300,000	----------	[3] 1,000,000
Raw (sold by producers) ....short tons..	503,427	1,978,222	503,688	1,871,403	404,278	1,657,398

Coal	do	53, 710, 346	116, 561, 332	62, 230, 766	146, 815, 230	61, 896, 000	160, 829, 000
Coke	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Fluorspar	do	142, 862	2, 957, 982	134, 133	3, 266, 257	109, 849	3, 122, 513
Iron, pig	do	329, 125	(1 3)	457, 124	(1 3)	706, 253	(1 3)
Lead	do	282	32, 148	335	44, 890	240	36, 000
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	69, 067, 000	28, 769, 000	80, 089, 000	33, 837, 000	92, 000, 000	39, 560, 000
Natural gasoline and allied products:							
Natural gasoline	gallons	10, 247, 000	475, 000	8, 884, 000	438, 000	10, 551, 000	601, 000
Liquefied petroleum gases	do	25, 124, 000	1, 055, 000	27, 798, 000	681, 000	32, 666, 000	850, 000
Ores (crude), etc.:							
Zinc	short tons	1, 455	(5)	101	(5)		
Zinc-lead	do	14, 885	(5)	1, 955	(5)	23, 818	(5)
Petroleum	barrels	4, 762, 000	6, 200, 000	4, 534, 000	6, 150, 000	7, 883, 000	10, 8
Sand and gravel	short tons	6 1, 654, 183	6 1, 124, 705	2, 403, 635	1, 743, 695	2, 298, 328	1
Stone	do	7 5, 779, 800	7 5, 177, 170	7 5, 641, 280	7 5, 454, 914	4, 621, 720	
Zinc	do	427	64, 050	407	75, 702	931	
Miscellaneous 8			14, 669, 799		13, 854, 017		
Total value, eliminating duplications			169, 009, 195		204, 294, 168		(1)

---

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included ur

[6] "Commercial." Value of "Government-and-contractor" inclu laneous."

[7] Exclusive of sandstone, value for which is included under "M

[8] Includes minerals indicated by "1," "6," and "7" above.

2 $500,000
(1)
(1 3)
(1 3)
77 783, 999

LOUISIANA

					(1)	(1)	(1)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						(4)	(4)
Products (other than pottery and refractories)			2 $874, 000		2 $650	(1)	(1)
Raw (sold by producers)	short tons	12, 159	100, 339	(1)	(1	3, 321, 047	1, 941, 241
Lime	do	(1)	(1)	(1)		3, 148	16, 050
Magnesium	do			(1)		1, 037	7, 259
Mineral waters	gallons sold	(3)	(3)	(3)	88	6 1, 370, 460	6 2, 170, 408
Natural gas	M cubic feet	403, 855, 000	71, 089, 000	447, 686, 000	970		15, 589, 194
Natural gasoline and allied products:							
Natural gasoline and cycle products	gallons	201, 049, 000	6, 376, 000	254, 362, 000	467, 398		5, 441, 000
Liquefied petroleum gases	do	24, 675, 000	388, 000	41, 712, 00			
Petroleum	barrels	115, 908, 000	132, 100, 000	115, 785,			
Salt	short tons	1, 242, 242	3, 251, 492	1, 33			
Sand and gravel	do	3, 700, 140	2, 386, 097	4, 6			
Stone	do	(1)	(1)				
Sulfur	long tons	549, 619	8, 793, 904				
Miscellaneous 4			3, 081, 212				
Total value, eliminating duplications			228, 440, 044				

nd-contractor" included under "Mis-
nd of sandstone in 1943, value for which is
," and "6" above.

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Includes minerals ind

Mineral products of the United States, 19

ontinued

MAINE

Product	
Beryllium ore	short tons
Cement	barrels
Clay products (other than pottery and refractories)	
Feldspar (crude)	long ton
Gems and precious stones	
Lime	short to
Lithium minerals	do
Mica:	
Scrap	d
Sheet	pou
Mineral waters	gallons
Peat	short
Sand and gravel	
Silica (quartz)	
Slate	
Stone	sh
Miscellaneous [5]	
Total value, eliminating duplications	

1942	1943	
Value	Quantity	Value
[1] $11,415,377	[1] 5,305,798	[1] $8,035,559
(2)	(2)	(2)
840,000		[3] 700,000
(4)	(4)	(4)
965	4,573,000	11,433,000
	(4)	(4)
46	9,213	1,381,950
	(4 5)	(4 5)
	(6)	(6)
,000	133,000,000	46,550,000
	9,870,000	3,284,000
	897,000	432,000
	495	(7)
	2	(7)
		127,400,000
		163,366
		4,197,507
		2,103,091
		291,198
		299,904
		0,499

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Cens ing certain classes of clay products.

Cement	barrels	(1)				
Clay:						
Products (other than pottery and refractories)			[2] $2,042			
Raw (sold by producers)	short tons	57,489	149,744			
Coal	do	1,700,574	4,088,426	2,00		
Coke	do	1,752,538	(1 3)	2,103,664		
Feldspar (crude)	long tons	(1)	(1)			
Iron, pig	short tons	2,372,932	(1 3)	2,493,946	(1 3)	
Lime	do	65,624	431,200	62,871	371,189	
Mica, scrap	do					(1)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)

STATISTICAL SUMMARY OF MINERAL PRODUCTION

icated by "1" above.

der the metals.

ded under "Miscel-

Miscellaneous."

, 129
15, 418
(1)
544, 100

8, 809, 000
1, 504, 000
137, 800, 000
3, 381, 856
3, 551, 750
(1)
8, 705, 600
2, 940, 485

246, 438, 691

(1)
(1)
(3)
79, 096, 000

(1)
(1)
(1)
(3)
490, 000, 000

235, 344, 000
70, 854, 000
123, 592, 000
1, 620, 382
3, 835, 749
(1)
567, 936

(1)

(1)
[2] $700, 000
(1)
(1)
(1)
(3)
87, 220, 000

9, 486, 000
2, 112, 000
149, 500, 000
3, 678, 068
3, 046, 172
(1)
9, 086, 976
2, 787, 459

267, 617, 000

00, 000
452, 298
4, 309, 201
201, 096
18, 182, 911

226, 597, 000

Potassium salts	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	5,167,445	4,446,850	5,940,123	5,547,434	4,658,609	4,115,389
Silica (quartz)	do	(1)	(1)	(1)	(1)	827	12,737
Slate		-----	(1)	-----	(1)	-----	(1)
Stone	short tons	1,604,430	2,218,478	1,220,190	1,807,265	1,423,970	2,029,927
Talc and ground soapstone	do	15,628	105,363	15,294	144,707	(1)	(1)
Miscellaneous [5]		-----	60,911,136	-----	74,094,738	-----	71,645,840
Total value, eliminating duplications		-----	17,291,523	-----	18,383,872	-----	17,095,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Includes minerals indicated by "1" above.

MASSACHUSETTS

Beryllium ore	short tons	-----	-----	-----	-----	(1)	(1)
Clay:							
Products (other than pottery and refractories)		-----	[2] $1,022,000	-----	[2] $900,000	-----	[2] $500,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coke	do	1,161,732	(1 3)	1,176,359	(1 3)	1,174,152	(1 3)
Feldspar (crude)	long tons	(1)	(1)	-----	-----	-----	-----
Iron, pig	short tons	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Lime	do	106,336	1,007,773	87,537	757,109	94,877	783,999
Manganiferous ore	do	4,480	(1)	(1)	(1)	-----	-----
Mica:							
Scrap	do	-----	-----	(1)	(1)	(1)	(1)
Sheet	pounds	-----	-----	-----	-----	(1)	(1)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	5,351,002	2,674,557	[5] 5,179,419	[5] 3,105,674	3,321,047	1,941,241
Sand and sandstone (ground)	do	1,352	6,327	2,761	13,948	3,148	16,050
Silica (quartz)	do	850	5,525	1,029	8,137	1,037	7,259
Stone	do	2,602,120	4,547,808	[6] 1,800,600	[6] 3,468,788	[6] 1,370,460	[6] 2,170,408
Miscellaneous [7]		-----	15,178,812	-----	15,521,970	-----	15,589,194
Total value, eliminating duplications		-----	9,293,169	-----	8,467,398	-----	5,441,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[6] Exclusive of dimension basalt in 1942 and of sandstone in 1943, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1," "3," and "4" above.

Mineral products of the United States, 1941–43, by States—Continued

MAINE

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Beryllium ore ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay products (other than pottery and refractories)		[2] $417,000		[2] $300,000		[2] $120,000
Feldspar (crude) ... long tons	22,566	116,610	8,835	53,143	6,748	41,652
Gems and precious stones		(3)		(3)		(3)
Lime ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals ... do			103	4,328		
Mica:						
Scrap ... do	276	5,243	(1)	(1)	(1)	(1)
Sheet ... pounds	694	276	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Peat ... short tons	8,527	178,058	3,832	110,478	1,871	60,033
Sand and gravel ... do	3,891,656	935,902	2,249,254	800,147	1,603,324	733,503
Silica (quartz) ... do	202	722	364	922	140	840
Slate		442,212		480,391		(1)
Stone ... short tons	324,060	1,295,180	[4] 196,010	[4] 556,655	201,450	409,780
Miscellaneous [5]		1,301,245		1,307,990		1,354,637
Total value, eliminating duplications		4,692,448		3,614,054		2,720,000

---

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[5] Includes minerals indicated by "1" and "4" above.

MARYLAND

Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $2,042,000		[2] $1,600,000		[2] $1,400,000
Raw (sold by producers) ... short tons	57,489	149,744	57,599	127,227	50,214	130,978
Coal ... do	1,700,574	4,088,426	2,000,934	5,205,516	1,850,000	5,402,000
Coke ... do	1,752,538	(1 3)	2,103,664	(1 3)	2,059,839	(1 3)
Feldspar (crude) ... long tons	(1)	(1)				
Iron, pig ... short tons	2,372,932	(1 3)	2,493,946	(1 3)	2,526,748	(1 3)
Lime ... do	65,624	431,200	62,871	371,189	78,386	530,989
Mica, scrap ... do					(1)	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)

Potassium salts	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel short tons	5,167,445	4,446,850	5,940,123	5,547,434	4,658,609	4,115,389
Silica (quartz) do	(1)	(1)	(1)	(1)	827	12,737
Slate do	----	(1)	----	(1)	----	(1)
Stone short tons	1,604,430	2,218,478	1,220,190	1,807,265	1,423,970	2,029,927
Talc and ground soapstone do	15,628	105,363	15,294	144,707	(1)	(1)
Miscellaneous [5]	----	60,911,136	----	74,094,738	----	71,645,840
Total value, eliminating duplications	----	17,291,523	----	18,383,872	----	17,095,000

---

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Includes minerals indicated by "1" above.

MASSACHUSETTS

Beryllium ore short tons	----	----	----	----	(1)	(1)
Clay:						
Products (other than pottery and refractories)	----	[2] $1,022,000	----	[2] $900,000	----	[2] $500,000
Raw (sold by producers) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coke do	1,161,732	(1 3)	1,176,359	(1 3)	1,174,152	(1 3)
Feldspar (crude) long tons	(1)	(1)	----	----	----	----
Iron, pig short tons	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Lime do	106,336	1,007,773	87,537	757,109	94,877	783,999
Manganiferous ore do	4,480	(1)	(1)	(1)	----	----
Mica:						
Scrap do	----	----	(1)	(1)	(1)	(1)
Sheet pounds	----	----	----	----	(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel do	5,351,002	2,674,557	[5] 5,179,419	[5] 3,105,674	3,321,047	1,941,241
Sand and sandstone (ground) do	1,352	6,327	2,761	13,948	3,148	16,050
Silica (quartz) do	850	5,525	1,029	8,137	1,037	7,259
Stone do	2,602,120	4,547,808	[6] 1,800,600	[6] 3,468,788	[6] 1,370,460	[6] 2,170,408
Miscellaneous [7]	----	15,178,812	----	15,521,970	----	15,589,194
Total value, eliminating duplications	----	9,293,169	----	8,467,398	----	5,441,000

---

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[6] Exclusive of dimension basalt in 1942 and of sandstone in 1943, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1," "3," and "4" above.

Mineral products of the United States, 1941–43, by States—Continued

MICHIGAN

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Bromine	pounds	15,899,731	$3,906,486	17,685,316	$4,589,747	19,846,772	$5,447,266
Calcium chloride	short tons	148,918	1,236,783	190,422	1,487,597	175,926	1,384,818
Cement	barrels	9,819,218	13,333,850	10,349,104	14,683,683	6,430,404	9,285,815
Clay:							
Products (other than pottery and refractories)		----------	[1] 2,925,000	----------	[1] 2,200,000	----------	[1] 1,500,000
Raw (sold by producers)	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Coal	do	310,775	1,312,777	231,148	1,020,833	180,000	853,000
Coke	do	2,863,563	[3] 18,213,048	3,139,137	[3] 21,793,813	2,948,389	[3] 22,006,821
Copper	pounds	92,880,000	10,959,840	91,358,000	11,054,318	93,528,000	12,158,640
Gems and precious stones		----------	(4)	----------	(4)	----------	(4)
Gypsum (crude)	short tons	805,861	1,090,309	891,180	1,286,242	538,602	737,719
Iron:							
Ore	long tons	15,201,619	43,765,164	16,129,474	45,599,536	14,510,357	40,258,096
Pig	short tons	1,360,139	[3] 21,384,383	1,675,143	[3] 25,718,214	1,492,942	[3] 24,782,464
Lime	do	55,447	388,104	58,283	420,523	96,554	717,401
Magnesium	do	8,929	4,285,960	(2)	(2)	(2)	(2)
Magnesium compounds (natural)	pounds	(2)	(2)	269,020,032	3,437,991	241,124,000	4,446,052
Manganiferous ore	short tons	----------	----------	(2)	(2)	(2)	(2)
Marl, calcareous	do	66,854	35,684	62,586	31,834	16,004	10,770
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	13,916,000	8,722,000	15,521,000	11,044,000	17,500,000	12,430,000
Natural gasoline	gallons	5,670,000	261,000	2,518,000	120,000	1,293,000	63,000
Ores (crude), etc.: Copper	short tons	4,282,448	(5)	4,362,640	(5)	4,403,594	(5)
Peat	do	11,340	75,500	(2)	(2)	(2)	(2)
Petroleum	barrels	16,359,000	21,900,000	21,754,000	30,300,000	20,768,000	29,300,000
Salt	short tons	3,620,649	10,975,872	3,946,591	12,583,964	4,284,685	14,472,820
Sand and gravel	do	15,606,215	6,190,336	15,542,941	7,362,231	11,750,989	5,588,850
Silver	troy ounces	60,796	43,233	61,674	43,857	48,479	34,474
Stone	short tons	15,161,820	8,349,607	16,093,050	9,433,035	15,919,780	9,669,672
Miscellaneous [6]		----------	2,676,168	----------	4,734,531	----------	8,516,687
Total value, eliminating duplications		----------	142,433,673	----------	161,433,922	----------	156,875,000

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[1] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[2] Value included under "Miscellaneous."

[3] Value not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Includes minerals indicated by "2" above.

MINNESOTA

Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $1,119,000		[2] $800,000		[2] $600,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coke	do	685,873	[3] 5,082,787	955,301	[3] 7,507,413	956,396	[3] 8,076,109
Ferro-alloys	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Flint lining for tube mills	do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones			(4)		(4)		(4)
Iron:							
Ore	long tons	62,874,891	167,781,967	73,865,165	179,752,236	68,634,724	168,536,802
Pig	short tons	369,549	(1 3)	373,595	(1 3)	532,761	(1 3)
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Manganiferous ore	do	1,327,388	3,055,967	(1)	(1)	(1)	(1)
Marl, calcareous	do	21,387	11,664	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat	short tons	(1)	(1)	2,427	21,332	4,264	58,843
Pebbles for grinding	do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	13,517,069	2,705,534	10,900,493	2,602,324	8,575,915	2,105,143
Stone	do	1,002,190	1,811,805	[5] 1,451,210	[5] 1,858,631	[5] 658,600	[5] 1,205,910
Miscellaneous [6]			10,888,974		15,948,662		17,812,178
Total value, eliminating duplications			178,790,274		191,649,723		177,687,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Exclusive of basalt in 1942 and of basalt and marble in 1943, value for which is included under "Miscellaneous."

[6] Includes minerals indicated by "1" and "5" above.

MISSISSIPPI

Bauxite	short tons			(1)	(1)		
Clay:							
Products (other than pottery and refractories)			[2] $915,000		[2] $700,000		[2] $700,000
Raw (sold by producers)	short tons	92,479	420,322	(1)	(1)	(1)	(1)
Iron ore	long tons	51	101				
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Natural gas	M cubic feet	4,268,000	1,084,000	2,082,000	557,000	1,400,000	385,000
Petroleum	barrels	15,327,000	14,000,000	28,833,000	26,600,000	18,807,000	18,400,000
Sand and gravel	short tons	[4] 2,192,829	[4] 1,018,504	3,257,551	1,766,367	[4] 1,855,207	[4] 1,098,745
Stone	do	[5] 500	[5] 750			(1)	(1)
Miscellaneous [6]			312,049		369,557		564,065
Total value, eliminating duplications			17,750,726		29,992,924		21,148,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[5] Exclusive of sandstone, value for which is included under "Miscellaneous."

[6] Includes minerals indicated by "1," "4," and "5" above.

Mineral products of the United States, 1941–43, by States—Continued

MISSOURI

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite	do	212,718	$1,337,756	146,270	$943,131	124,147	$872,044
Cement	barrels	6,516,345	10,272,509	7,397,960	11,515,907	4,464,943	7,024,285
Chats	short tons	2,182,372	458,696	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)		----	[3] 3,032,000	----	[3] 2,300,000	----	[3] 1,600,000
Raw (sold by producers)	short tons	805,813	1,798,342	1,132,842	2,468,170	1,242,174	2,538,898
Coal	do	3,145,288	7,013,745	3,519,877	8,372,358	3,802,000	9,505,000
Coke	do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Copper	pounds	2,800,000	330,400	2,600,000	314,600	2,680,000	348,400
Iron ore—							
Sold to furnaces, etc.	long tons	13,410	35,543	55,578	177,587	52,893	153,997
Sold for paint	do	5,063	23,649				
Lead	short tons	165,909	18,913,626	199,548	26,739,432	184,910	27,736,500
Lime	do	736,200	4,106,468	853,020	4,915,784	963,301	6,046,453
Manganese ore	do	12	(1)	(1)	(1)	(1)	(1)
Mineral paints (zinc and lead pigments)	do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas	M cubic feet	196,000	100,000	100,000	52,000	100,000	52,000
Ores (crude), etc.:							
Lead	short tons	5,737,322	(6)	7,107,453	(6)	6,832,794	(6)
Zinc	do	158,334	(6)	823,305	(6)	1,244,418	(6)
Zinc-lead	do	896,938	(6)	1,368,000	(6)	1,362,939	(6)
Petroleum	barrels	47,000	41,000	36,000	41,000	36,000	(1)
Sand and gravel	short tons	5,401,903	3,220,086	4,490,650	2,931,924	3,250,533	2,298,556
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silver	troy ounces	367,688	261,467	69,106	49,142	111,285	79,136
Stone	short tons	6,501,460	7,048,207	[2, 7] 9,235,540	[2, 7] 8,347,132	[2] 5,636,040	[2] 5,864,005
Tripoli	do	(1)	(1)	(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates)	do	3	(1)	----	----	(1)	(1)
Zinc	do	21,932	3,289,800	36,394	6,769,284	30,413	6,569,208
Miscellaneous [8]		----	2,364,610	----	2,664,855	----	3,020,865
Total value, eliminating duplications		----	61,545,052	----	76,122,304	----	70,945,000

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[1] Value included under "Miscellaneous."
[2] After 1941, chats included in figures for stone.
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of crushed marble, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

MONTANA

Antimony ore (concentrates) short tons	113	$5,400	(1)	(1)	----	----
Arsenious oxide do	(1)	(1)	(1)	(1)	(1)	(1)
Bismuth pounds	(2)	(2)	(2)	(2)	(2)	(2)
Calcite (Iceland spar) do	----	----	----	----	(1)	(1)
Cement barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chromite short tons	----	----	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	----	[3] 231,000	----	[3] $200,000	----	[3] $150,000
Raw (sold by producers) short tons	(1)	(1)	10,928	8,270	(1)	(1)
Coal:						
Bituminous do	3,194,931	4,725,392	3,779,544	6,129,488	4,645,000	7,897,000
Lignite do	58,793	105,000	49,138	93,000	52,000	133,000
Copper pounds	256,072,000	30,216,496	282,388,000	34,168,948	269,050,000	34,976,500
Gems and precious stones	----	(4)	----	(4)	----	(4)
Gold troy ounces	246,475	8,626,625	146,892	5,141,220	59,586	2,085,510
Graphite, crystalline pounds	(1)	(1)	----	----	(1)	(1)
Gypsum (crude) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lead do	21,259	2,423,526	20,050	2,686,700	16,324	2,448,600
Lime do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore do	54,565	(1)	(1)	(1)	(1)	(1)
Manganiferous ore do	4,988	(1)	(1)	(1)	(1)	(1)
Mica, sheet pounds	----	----	----	----	(1)	(1)
Mineral waters gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas M cubic feet	28,499,000	7,597,000	31,475,000	8,293,000	32,000,000	8,480,000
Natural gasoline and allied products:						
Natural gasoline gallons	2,517,000	177,000	2,810,000	201,000	2,748,000	180,000
Liquefied petroleum gases do	1,449,000	81,000	1,707,000	96,000	1,915,000	110,000
Ores (crude), etc.:						
Copper short tons	3,791,202	(5)	4,338,714	(5)	5,068,865	(5)
Dry and siliceous (gold and silver) do	940,067	(5)	533,524	(5)	266,972	(5)
Lead do	33,029	(5)	15,936	(5)	8,449	(5)
Lead-copper do	4	(5)	----	----	----	----
Zinc do	182,745	(5)	218,235	(5)	234,361	(5)
Zinc-lead do	695,202	(5)	571,871	(5)	294,369	(5)
Petroleum barrels	7,526,000	8,000,000	8,074,000	8,950,000	7,916,000	9,500,000
Phosphate rock long tons	105,108	318,588	150,402	572,464	119,764	488,665
Platinum metals (crude) troy ounces	41	(1)	----	----	----	----
Pyrites long tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel short tons	4,706,685	1,871,912	5,246,242	2,986,468	2,553,080	1,155,621
Silver troy ounces	12,386,925	8,808,480	11,188,118	7,955,995	8,450,370	6,009,152
Stone short tons	455,680	336,632	393,200	303,250	509,540	365,777
Talc do	(1)	(1)	(1)	(1)	(1)	(1)
Tin (metallic equivalent) pounds	(1)	(1)	----	----	----	----
Tungsten ore (60-percent concentrates) short tons	7	(1)	(1)	(1)	----	----
Vermiculite do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc do	60,710	9,106,500	54,715	10,176,990	37,606	8,122,896
Miscellaneous [6]	----	3,952,909	----	8,718,811	----	9,530,129
Total value, eliminating duplications	----	86,583,460	----	96,681,604	----	91,633,000

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[1] Value included under "Miscellaneous."

[2] Figures not available.

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Includes minerals indicated by "1" above.

Mineral products of the United States, 1941–43, by States—Continued

NEBRASKA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)		----------	[2] $659,000	----------	[2] $400,000	----------	[2] $400,000
Raw (sold by producers)	short tons	11,969	6,048	15,983	13,991	12,737	14,754
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Petroleum	barrels	1,898,000	1,600,000	1,237,000	1,110,000	635,000	600,000
Pumice	short tons	7,512	54,513	6,837	47,194	(1)	(1)
Sand and gravel	do	3,176,701	1,273,066	6,527,665	3,241,622	4,526,510	2,391,463
Stone	do	[4] 328,690	[4] 660,573	267,020	630,413	538,380	968,932
Miscellaneous		----------	2,245,870	----------	2,984,980	----------	2,454,833
Total value, eliminating duplications		----------	6,499,070	----------	8,428,200	----------	6,830,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Exclusive of dimension limestone, value for which is included under "Miscellaneous."

NEVADA

Product		1941 Quantity	1941 Value	1942 Quantity	1942 Value	1943 Quantity	1943 Value
Antimony ore (concentrates)	short tons	691	$15,300	(1)	(1)	(1)	(1)
Arsenious oxide	do	(2)	(2)	(1)	(1)	(2)	(2)
Barite	do	(1)	(1)	(1)	(1)	12,157	$49,900
Bismuth	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)		----------	(1 3)	----------	(1 3)	----------	(1 3)
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cobalt	pounds	410	(1)	(1)	(1)	----------	----------
Copper	do	157,822,000	18,622,996	167,326,000	$20,246,446	142,136,000	18,477,680
Diatomite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Dumortierite	do	(1)	(1)	(1)	(1)	(1)	(1)
Fluorspar	do	8,967	(1)	8,020	(1)	8,653	(1)
Fuller's earth	do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		----------	(4)	----------	(4)	----------	(4)
Gold	troy ounces	366,403	12,824,105	295,112	10,328,920	144,442	5,055,470
Graphite, amorphous	short tons	(1)	(1)	----------	----------	(1)	(1)
Gypsum (crude)	do	284,795	754,294	330,333	540,579	347,961	702,906
Iron ore	long tons	215	645	----------	----------	7,368	37,856
Lead	short tons	9,623	1,097,022	5,376	720,384	4,790	718,500
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite	do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium	do	----------	----------	(1)	(1)	(1)	(1)
Magnesium oxide (hydrated) (brucite)	do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore	do	2,937	(1)	(1)	(1)	(1)	(1)
Manganiferous ore	do	8,913	(1)	(1)	(1)	(1)	(1)

Marl, calcareous	do	(1)	(1)	(1)	(1)	(1)	(1)
Mercury	flasks (76 pounds)	4, 238	784, 115	5, 201	1, 021, 217	4, 577	893, 476
Mica, sheet	pounds					(1)	(1)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Ores (crude), etc.:							
Copper	short tons	6, 850, 444	(5)	7, 904, 443	(5)	7, 721, 562	(5)
Dry and siliceous (gold and silver)	do	1, 783, 923	(5)	1, 317, 410	(5)	462, 175	(5)
Lead	do	26, 838	(5)	32, 081	(5)	22, 297	(5)
Lead-copper	do			7	(5)		
Zinc	do	1, 488	(5)	47, 522	(5)	156, 845	(5)
Zinc-lead	do	136, 942	(5)	81, 916	(5)	1, 164	(5)
Quartz crystal	pounds					(1)	(1)
Salt	short tons			(1)	(1)	30, 291	53, 009
Sand and gravel	do	2, 170, 145	894, 721	2, 735, 859	1, 508, 471	1, 741, 011	929, 347
Silver	troy ounces	5, 830, 238	4, 145, 947	3, 723, 435	2, 647, 776	1, 620, 280	1, 152, 199
Stone	short tons	183, 170	226, 827	137, 920	196, 726	107, 390	165, 483
Sulfur ore	long tons	60	503				
Talc and pinite	short tons	13, 178	126, 433	12, 339	236, 033	11, 791	171, 351
Tin (metallic equivalent)	do			(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates)	do	2, 289	3, 241, 759	(1)	(1)	(1)	(1)
Vanadium	pounds			(1)	(1)	(1)	(1)
Vermiculite	short tons			(1)	(1)		
Zinc	do	15, 129	2, 269, 350	10, 197	1, 896, 642	13, 647	2, 947, 752
Miscellaneous [6]			1, 336, 993		6, 864, 767		24, 956, 706
Total value, eliminating duplications			46, 341, 010		46, 207, 961		56, 312, 000

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[1] Value included under "Miscellaneous."
[2] Figures not available.
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

NEW HAMPSHIRE

Beryllium ore	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Clay products (other than pottery and refractories)			[2] $389, 000		[2] $290, 000		[2] $200, 000
Feldspar (crude)	long tons	52, 219	200, 569	46, 544	241, 990	(1)	(1)
Gems and precious stones			(3)		(3)		(3)
Mica:							
Scrap	short tons	171	3, 700	(1)	(1)	(1)	(1)
Sheet	pounds	394, 907	65, 104	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Peat	short tons	132	1, 773	(1)	(1)	80	1, 705
Sand and gravel	do	1, 894, 074	336, 538	1, 287, 394	159, 058	611, 582	126, 325
Scythestones	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	(1)	(1)				
Stone	do	[4] 167, 270	[4] 373, 157	237, 090	440, 714	70, 910	171, 371
Miscellaneous [5]			12, 665		79, 422		850, 157
Total value, eliminating duplications			1, 382, 506		1, 211, 184		1, 350, 000

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[1] Value included under "Miscellaneous."
[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[3] No canvass.
[4] Exclusive of basalt, value for which is included under "Miscellaneous."
[5] Includes minerals indicated by "1" and "4" above.

Mineral products of the United States, 1941–43, by States—Continued

NEW JERSEY

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminum	short tons					(1 2)	(1 2)
Cement	barrels	(1)	(1)	(1)	(1)		
Clay:							
Products (other than pottery and refractories)			[3] $7,052,000		[3] $5,300,000		[3] $4,500,000
Raw (sold by producers)	short tons	137,065	744,314	117,238	678,817	153,569	705,956
Coke	do	1,031,569	(1 2)	1,038,461	(1 2)	1,014,268	(1 2)
Ferro-alloys	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore	long tons	666,550	3,437,082	603,360	3,672,750	521,795	3,584,229
Lime	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium oxide (magnesia)	pounds			(1)	(1)	(1)	(1)
Manganiferous residuum	short tons	282,049	(1)	(1)	(1)	(1)	(1)
Marl, greensand	do	11,120	619,664	10,110	448,440	10,056	522,124
Mineral paints (zinc and lead pigments)	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Ore (zinc)	short tons	585,463	(5)	607,766	(5)	602,646	(5)
Peat	do	11,697	55,969	7,885	40,540	11,060	66,813
Sand and gravel	do	5,964,869	4,897,039	6,032,978	5,726,860	[6] 5,020,373	[6] 5,217,688
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	(1)	(1)	(1)	(1)	(1)	(1)
Stone	do	3,206,050	3,782,036	3,393,510	3,776,745	2,611,440	3,584,645
Zinc [7]	do	93,781	14,855,073	94,040	16,517,146	92,864	16,249,518
Miscellaneous [8]			11,230,738		11,096,314		18,600,318
Total value, eliminating duplications			39,074,518		38,921,351		37,583,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metal.
[6] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[7] Value reported for zinc in New Jersey is estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[8] Includes minerals indicated by "1" and "6" above.

NEW MEXICO

Arsenious oxide	**short tons**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**
Beryllium ore	**do**					**(2)**	**(2)**
Bismuth	**pounds**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**	**(1)**
Clay:							
Products (other than pottery and refractories)			**[3] $185,000**		**[3] $140,000**		**[3] $120,000**
Raw (sold by producers)	**short tons**	**13,458**	**22,934**	**12,446**	**16,847**	**5,772**	**16,908**
Coal	**do**	**1,251,120**	**3,788,488**	**1,668,659**	**5,248,910**	**1,816,000**	**6,610,000**
Copper	**pounds**	**146,956,000**	**17,340,808**	**160,200,000**	**19,384,200**	**152,326,000**	**19,802,380**

Diatomite	short tons	(2)	(2)			(2)	(2)
Fluorspar	do	(2)	(2)	(2)	(2)	37, 050	986, 094
Fuller's earth	do	(2)	(2)				
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	27, 845	974, 575	11, 961	418, 635	5, 563	194, 705
Iron ore	long tons			95, 809	299, 097	41, 744	104, 076
Lead	short tons	4, 668	532, 152	4, 608	617, 472	5, 723	858, 450
Lime	do	(2)	(2)	(2)	(2)	(2)	(2)
Lithium minerals	do					41	2, 038
Magnesium chloride (natural)	pounds					(2)	(2)
Manganese ore	short tons			(2)	(2)	(2)	(2)
Manganiferous ore	do	65, 483	219, 401	(2)	(2)	(2)	(2)
Mica:							
Scrap	do	(2)	(2)	(2)	(2)	(2)	(2)
Sheet	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Molybdenum	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Natural gas	M cubic feet	64, 655, 000	11, 339, 000	78, 164, 000	13, 167, 000	85, 000, 000	14, 450, 000
Natural gasoline and allied products:							
Natural gasoline	gallons	69, 115, 000	2, 049, 000	73, 862, 000	2, 131, 000	72, 749, 000	3, 783, 000
Liquefied petroleum gases	do	11, 885, 000	228, 000	15, 302, 000	267, 000	8, 481, 000	187, 000
Ores (crude), etc.:							
Copper	short tons	6, 975, 682	(5)	7, 631, 752	(5)	7, 571, 937	(5)
Dry and siliceous (gold and silver)	do	108, 017	(5)	37, 831	(5)	2, 916	(5)
Lead	do	2, 261	(5)	694	(5)	586	(5)
Lead-copper	do			618	(5)	60	(5)
Zinc	do	148, 359	(5)	330, 239	(5)	361, 391	(5)
Zinc-lead	do	295, 907	(5)	220, 378	(5)	392, 153	(5)
Petroleum	barrels	39, 569, 000	37, 200, 000	31, 544, 000	31, 550, 000	38, 411, 000	38, 400, 000
Potassium salts	short tons	[6] 433, 677	14, 084, 716	[6] 548, 730	19, 631, 297	[6] 604, 414	21, 918, 503
Pumice	do	(2)	(2)	7, 396	294, 331	4, 837	202, 558
Salt	do	16, 641	51, 514	13, 956	47, 265	10, 829	21, 427
Sand and gravel	do	[7] 1, 948, 587	[7] 1, 269, 813	[8] 261, 358	[8] 146, 866	[8] 230, 458	[8] 147, 624
Silver	troy ounces	1, 328, 317	944, 581	676, 170	480, 832	463, 583	329, 659
Stone	short tons	118, 180	111, 709	515, 240	248, 895	[9] 421, 590	[9] 228, 432
Talc	do			(2)	(2)	(2)	(2)
Tantalum and columbium ores	pounds					(2)	(2)
Tin (metallic equivalent)	short tons	5	5, 620	(2)	(2)	(2)	(2)
Tungsten ore (60-percent concentrates)	do	(2)	(2)				
Vanadium	pounds					(2)	(2)
Zinc	short tons	37, 862	5, 679, 300	46, 461	8, 641, 746	59, 524	12, 857, 184
Miscellaneous [10]			1, 822, 475		4, 079, 802		3, 171, 484
Total value, eliminating duplications			97, 849, 086		106, 811, 195		124, 392, 000

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[1] Figures not available.

[2] Value included under "Miscellaneous."

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Equivalent as K_2O.

[7] "Government-and-contractor." Value of "Commercial" included under "Miscellaneous."

[8] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[9] Exclusive of granite, value for which is included under "Miscellaneous."

[10] Includes minerals indicated by "2," "7," "8," and "9" above.

Mineral products of the United States, 1941–43, by States—Continued

NEW YORK

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Aluminum	short tons	91,391	[1] $29,701,137	(1 2)	(1 2)	(1 2)	(1 2)
Cement	barrels	[3] 11,446,292	[3] 16,073,726	[3] 11,027,118	[3] $16,030,995	[3] 5,914,660	[3] $8,765,665
Clay:							
Products (other than pottery and refractories)			[4] 8,111,000		[4] 6,000,000		[4] 3,000,000
Raw (sold by producers)	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Coke	do	5,116,308	[4] 32,808,937	5,180,384	[1] 37,660,727	5,347,369	[1] 39,091,561
Diatomite	do	(2)	(2)			(2)	(2)
Emery	do	4,876	42,484	5,277	49,413	6,666	63,195
Feldspar (crude)	long tons	(2)	(2)	(2)	(2)	(2)	(2)
Ferro-alloys	short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Garnet, abrasive	do	(2)	(2)	(2)	(2)	(2)	(2)
Gems and precious stones			(5)		(5)		(5)
Graphite:							
Artificial	pounds	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Crystalline	do	(2)	(2)	(2)	(2)		
Gypsum (crude)	short tons	1,080,320	1,500,307	1,012,987	1,605,530	713,961	1,229,796
Iron:							
Ore—							
Sold to furnaces	long tons	(2)	(2)	(2)	(2)	(2)	(2)
Sold for paint	do	8,253	56,900				
Pig	short tons	3,724,989	[1] 66,718,244	4,011,238	[1] 78,734,591	3,953,462	[1] 79,873,775
Lead	do	2,100	239,400	2,434	326,156	2,355	353,250
Lime	do	62,339	463,230	68,443	552,411	121,890	976,692
Magnesium	do					(2)	(2)
Marl, calcareous	do	(2)	(2)	(2)	(2)	(2)	(2)
Mica:							
Scrap	do	(2)	(2)				
Sheet	pounds	(2)	(2)				
Millstones			3,558		(2)		(2)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas	M cubic feet	10,456,000	7,853,000	8,718,000	6,498,000	7,400,000	5,550,000
Natural gasoline	gallons	17,000	1,000	15,000	1,000	14,000	1,000
Ores (crude), etc.:							
Zinc	short tons	151,808	(6)	167,923	(6)	154,001	(6)
Zinc-lead	do	336,271	(6)	380,893	(6)	359,944	(6)
Peat	do	13,905	105,120	9,000	41,000	(2)	(2)
Petroleum	barrels	5,185,000	13,300,000	5,421,000	16,000,000	5,059,000	15,200,000
Pyrites	long tons	63,958	(2)	68,826	250,527	62,907	227,723
Salt	short tons	2,719,586	7,416,734	2,722,670	8,158,147	2,926,388	9,328,672
Sand and gravel	do	[7] 14,923,149	[7] 10,096,875	16,285,367	11,841,245	[7] 7,375,378	[7] 5,256,547
Silica (quartz)	do	(2)	(2)	(2)	(2)		

Silver	troy ounces	37,734	26,833	40,012	28,453	38,004	27,025
Slate			685,145		659,590		613,566
Stone	short tons	10,406,740	10,806,450	11,244,670	11,513,020	8,660,970	8,917,164
Talc	do	153,560	1,917,732	136,752	1,886,678	136,291	2,003,080
Titanium concentrates: Ilmenite	do			(2)	(2)	165,198	(2)
Wollastonite	do					(2)	(2)
Zinc	do	38,446	5,766,900	45,807	8,520,102	46,000	9,936,000
Miscellaneous [8]			48,382,491		107,459,593		146,687,044
Total value, eliminating duplications			91,582,704		103,298,336		87,942,000

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[1] Value not included in total value for State.

[2] Value included under "Miscellaneous."

[3] Exclusive of natural cement, value for which is included under "Miscellaneous."

[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metals.

[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[8] Includes minerals indicated by "2," "3," and "7" above.

NORTH CAROLINA

Aluminum	short tons	39,513	[1] $12,841,515	(1 2)	(1 2)	(1 2)	(1 2)
Asbestos	do	(2)	(2)	(2)	(2)	(2)	(2)
Beryllium ore	do					(2)	(2)
Bromine	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)			[3] 5,356,000		[3] $4,000,000		[3] $3,000,000
Raw (sold by producers)	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Copper	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Feldspar (crude)	long tons	100,016	552,386	93,644	533,448	112,144	656,182
Flint lining for tube mills	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Garnet, abrasive	do	(2)	(2)	(2)	(2)	(2)	(2)
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	3,244	113,540	4,077	142,695	131	4,585
Kyanite	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Lime	do	(2)	(2)	(2)	(2)	(2)	(2)
Lithium minerals	do	(2)	(2)	(2)	(2)	(2)	(2)
Manganese ore	do	35	(2)			(2)	(2)
Manganiferous ore	do	174	(2)			(2)	(2)
Marl, calcareous	do	(2)	(2)				
Mica:							
Scrap	do	18,234	268,596	(2)	(2)	(2)	(2)
Sheet	pounds	1,614,863	318,783	(2)	(2)	(2)	(2)
Millstones			(2)		(2)		(2)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Olivine	short tons	4,828	24,401	5,739	45,201	5,415	48,633
Ores (crude):							
Copper	do	19,402	(5)	20,354	(5)	24,332	(5)
Dry and siliceous (gold and silver)	do	14,344	(5)	20,075	(5)		
Pebbles for grinding	do	6,099	102,895	(2)	(2)	(2)	(2)

See footnotes at end of State table.

Mineral products of the United States, 1941–43, by States—Continued

NORTH CAROLINA—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Quartz crystal	pounds					(²)	(²)
Sand and gravel	short tons	4,473,297	$2,345,165	4,280,198	$2,491,820	3,046,168	$1,823,516
Sand and sandstone (ground)	do					(²)	(²)
Silica (quartz)	do	(²)	(²)	(²)	(²)	(²)	(²)
Silver	troy ounces	7,439	5,290	8,259	5,873	7,169	5,098
Stone	short tons	3,820,200	4,806,623	3,039,580	3,774,472	4,871,260	5,376,600
Talc, pyrophyllite, and ground soapstone	do	64,783	567,921	56,909	503,082	65,698	580,106
Tantalum and columbium ores: Columbium ore	pounds					(²)	(²)
Titanium concentrates: Ilmenite	short tons			(²)	(²)	(²)	(²)
Tungsten ore (60-percent concentrates)	do					(²)	(²)
Vermiculite	do	(²)	(²)	1,612	19,048	(²)	(²)
Miscellaneous[6]			4,453,861		20,127,051		26,187,338
Total value, eliminating duplications			18,915,461		17,372,690		22,172,000

[1] Value not included in total value for State.

[2] Value included under "Miscellaneous."

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Includes minerals indicated by "2" above.

NORTH DAKOTA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Clay:							
Products (other than pottery and refractories)			(¹ ²)		(¹ ²)		(¹ ²)
Raw (sold by producers)	short tons	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Coal	do	2,308,888	$2,937,000	2,537,016	$3,554,000	2,614,000	$3,889,000
Mineral waters	gallons sold	(³)	(³)	(³)	(³)	(³)	(³)
Natural gas	M cubic feet	47,000	16,000	122,000	40,000	177,000	58,000
Sand and gravel	short tons	2,636,039	238,864	2,509,684	343,612	1,459,232	550,263
Stone	do	18,590	19,713	(¹)	(¹)		
Miscellaneous[4]			116,050		90,396		60,024
Total value, eliminating duplications			3,327,627		4,028,008		4,557,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Includes minerals indicated by "1" above.

OHIO

Bromine	pounds	(1)	(1)	(1)	(1)	46,264	$9,042
Calcium chloride	short tons	(1)	(1)	(1)	(1)	224	1,239
Cement	barrels	[2] 8,021,857	[2] $10,657,677	[2] 8,652,196	[2] $11,897,607	6,096,187	8,798,964
Clay:							
Products (other than pottery and refractories)			[3] 27,556,000		[3] 20,000,000		[3] 15,000,000
Raw (sold by producers)	short tons	741,655	1,711,068	807,905	1,650,976	793,668	1,615,431
Coal	do	29,318,843	58,473,076	32,764,468	68,810,518	31,935,000	77,283,000
Coke	do	9,284,194	[4] 48,491,596	9,912,783	[4] 59,087,481	10,270,758	[4] 64,405,750
Ferro-alloys	do	185,110	[4] 11,769,110	(1 4)	(1 4)	(1 4)	(1 4)
Grindstones	do	13,296	426,929	12,530	415,766	10,388	381,959
Gypsum (crude)	do	(1)	(1)	(1)	(1)	(1)	(1)
Iron, pig	do	12,995,298	[4] 268,660,861	13,153,014	[4] 284,600,670	13,750,856	[4] 299,483,340
Lime	do	1,549,246	12,482,106	1,418,161	11,739,547	1,469,654	12,001,684
Magnesium	do			(1)	(1)	(1)	(1)
Marl, calcareous	do	(1)	(1)				
Mineral paints (zinc and lead pigments)	do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas	M cubic feet	41,858,000	21,232,000	45,055,000	23,715,000	48,000,000	24,960,000
Natural gasoline	gallons	8,217,000	401,000	6,975,000	389,000	6,473,000	337,000
Peat	short tons	1,495	11,342	1,117	7,767	739	6,298
Petroleum	barrels	3,510,000	5,750,000	3,543,000	6,730,000	3,322,000	6,800,000
Salt	short tons	2,510,096	3,367,544	2,711,188	3,864,588	2,818,928	3,824,508
Sand and gravel	do	12,473,145	9,230,358	13,753,393	10,570,888	12,569,930	10,003,339
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Scythestones, whetstones, etc	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	(1)	(1)	(1)	(1)		
Stone	do	[6] 13,842,870	[6] 12,469,498	14,831,660	13,546,490	15,909,740	15,598,542
Sulfuric acid [7]	do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [8]			3,446,817		13,796,899		25,222,091
Total value, eliminating duplications			164,826,884		175,548,629		186,366,000

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[1] Value included under "Miscellaneous."

[2] Exclusive of natural cement, value for which is included under "Miscellaneous."

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] Value not included in total value for State.

[5] No canvass.

[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[7] From zinc-roasting operation.

[8] Includes minerals indicated by "1," "2," and "6" above.

Mineral products of the United States, 1941–43, by States—Continued

OKLAHOMA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chats	short tons	2,748,168	$383,797	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)			[3] 838,000		[3] $630,000		[3] $700,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coal	do	1,771,108	4,700,104	2,387,192	6,777,351	2,452,000	7,184,000
Gypsum (crude)	do	258,258	344,489	243,545	321,652	(1)	(1)
Iron ore	long tons	208	(1)				
Lead	short tons	25,021	2,852,394	22,806	3,056,004	19,733	2,959,950
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore	do	40	(1)	(1)	(1)	(1)	(1)
Manganiferous ore	do	56	(1)				
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	234,054,000	29,821,000	269,704,000	38,270,000	292,000,000	42,340,000
Natural gasoline and allied products:							
Natural gasoline	gallons	362,247,000	16,084,000	336,707,000	12,655,000	307,384,000	16,291,000
Liquefied petroleum gases	do	91,136,000	2,076,000	108,408,000	2,853,000	114,789,000	2,755,000
Ores (crude), etc.:							
Lead	short tons	15,589	(5)			4	(5)
Zinc	do	6,430,723	(5)	3,316,888	(5)	9,785,962	(5)
Zinc-lead	do	7,437,677	(5)	9,481,535	(5)	3,874,225	(5)
Petroleum	barrels	154,702,000	174,800,000	140,690,000	168,000,000	123,152,000	146,600,000
Pumice	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Salt	do	10,743	42,737	8,305	35,132	7,716	30,496
Sand and gravel	do	1,513,988	627,864	3,109,630	1,946,644	2,141,705	1,191,929
Stone	do	1,876,570	1,945,753	[2] 5,946,520	[2] 3,172,547	[2] 6,169,750	[2] 3,205,329
Sulfuric acid [6]	do	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)
Tripoli	do	(1)	(1)			(1)	(1)
Zinc	do	166,602	24,990,300	146,510	27,250,860	114,085	24,642,360
Miscellaneous [8]			4,695,858		6,770,356		5,852,014
Total value, eliminating duplications			263,763,923		271,298,469		253,284,000

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[1] Value included under "Miscellaneous."
[2] After 1941, chats included in figures for stone.
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] From zinc smelting.
[7] Value not included in total value for State.
[8] Includes minerals indicated by "1" above.

OREGON

Aluminum	short tons	--------	--------	(1 2)	(1 2)	(1 2)	(1 2)
Antimony ore (concentrates)	do	(1)	(1)	(1)	(1)	(1)	(1)
Arsenious oxide	do	(3)	(3)	(3)	(3)	(3)	(3)
Asbestos	do	3	$588	(1)	(1)	(1)	(1)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chromite	short tons	840	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)		--------	[4] 458,000	--------	[4] $450,000	--------	[4] $500,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coal	do	(1)	(1)	2,137	9,492	(1)	(1)
Copper	pounds	166,000	19,588	206,000	24,926	12,000	1,560
Diatomite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Gems and precious stones		--------	(5)	--------	(5)	--------	(5)
Gold	troy ounces	96,565	3,379,775	46,233	1,618,155	1,097	38,395
Lead	short tons	59	6,726	23	3,082	4	600
Lime	do	3,940	21,524	(1)	(1)	(1)	(1)
Manganese ore	do	85	(1)	(1)	(1)	(1)	(1)
Mercury	flasks (76 pounds)	9,032	1,671,101	6,935	1,361,687	4,651	907,922
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Ores (crude), etc.:							
Copper	short tons	629	(6)	58	(6)	34	(6)
Dry and siliceous (gold and silver)	do	97,531	(6)	31,670	(6)	2,646	(6)
Platinum metals (crude)	troy ounces	80	(1)	(1)	(1)	--------	--------
Pumice	short tons	677	8,544	(1)	(1)	--------	--------
Sand and gravel	do	3,968,395	2,159,470	6,660,311	4,497,514	[7] 4,013,846	[7] 3,473,708
Silica (quartz)	do	(1)	(1)	--------	--------	--------	--------
Silver	troy ounces	276,158	196,379	87,376	62,134	10,523	7,483
Stone	short tons	2,836,390	2,436,783	2,596,030	2,635,086	1,535,490	1,834,271
Miscellaneous [8]		--------	3,092,259	--------	7,782,185	--------	19,692,309
Total value, eliminating duplications		--------	12,830,176	--------	14,065,572	--------	12,310,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures not available.
[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral products of the United States, 1941–43, by States—Continued

PENNSYLVANIA

Product		1941 Quantity	1941 Value	1942 Quantity	1942 Value	1943 Quantity	1943 Value
Cement	barrels	[1] 32, 868, 220	[1] $45, 383, 766	[1] 33, 639, 025	[1] $46, 377, 469	[1] 19, 551, 388	[1] $27, 907, 236
Clay:							
Products (other than pottery and refractories)		------------	[2] 12, 550, 000	------------	[2] 9, 400, 000	------------	[2] 7, 000, 000
Raw (sold by producers)	short tons	1, 234, 367	3, 045, 688	1, 279, 398	3, 223, 172	1, 195, 862	3, 199, 927
Coal:							
Anthracite	do	56, 368, 267	240, 275, 000	60, 327, 729	271, 673, 000	60, 643, 620	306, 816, 018
Bituminous	do	130, 239, 683	296, 912, 296	144, 073, 189	356, 877, 215	141, 575, 000	396, 410, 000
Cobalt	pounds	(3)	(3)	(3)	(3)	(3)	(3)
Coke	short tons	21, 523, 472	[4] 97, 735, 965	23, 619, 504	[4] 118, 557, 069	23, 453, 317	[4] 135, 887, 231
Copper [5]	pounds	(3)	(3)	(3)	(3)	(3)	(3)
Feldspar (crude)	long tons	(3)	(3)	(3)	(3)	(3)	(3)
Ferro-alloys	short tons	688, 825	[4] 94, 266, 814	(3 4)	(3 4)	(3 4)	(3 4)
Gems and precious stones		------------	(6)	------------	(6)	------------	(6)
Gold [5]	troy ounces	2, 422	84, 770	2, 499	87, 465	2, 218	77, 630
Graphite, crystalline	pounds	------------	------------	------------	------------	(3)	(3)
Iron:							
Ore—							
Sold to furnaces	long tons	(3)	(3)	(3)	(3)	(3)	(3)
Sold for paint	do	3, 606	15, 630				
Pig	short tons	16, 340, 965	[4] 344, 298, 435	18, 038, 237	[4] 388, 006, 953	18, 593, 220	[4] 399, 568, 279
Lime	do	1, 003, 039	7, 263, 779	1, 030, 156	7, 708, 095	1, 021, 215	7, 864, 323
Manganese ore	do	------------	------------	(3)	(3)	------------	------------
Mica:							
Scrap	do	(3)	(3)	------------	------------	------------	------------
Sheet	pounds	------------	------------	------------	------------	(3)	(3)
Mineral paints (zinc and lead pigments)	short tons	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters	gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas	M cubic feet	92, 819, 000	42, 974, 000	93, 532, 000	44, 783, 000	96, 000, 000	46, 272, 000
Natural gasoline and allied products:							
Natural gasoline	gallons	15, 440, 000	705, 000	14, 876, 000	712, 000	16, 982, 000	883, 000
Liquefied petroleum gases	do	571, 000	42, 000	418, 000	37, 000	451, 000	40, 000
Peat	short tons	5, 440	12, 600	3, 434	9, 061	5, 790	14, 925
Petroleum	barrels	16, 750, 000	42, 500, 000	17, 779, 000	52, 250, 000	15, 757, 000	47, 300, 000
Pyrites	long tons	(3)	(3)	(3)	(3)	(3)	(3)
Sand and gravel	short tons	10, 515, 940	9, 936, 898	10, 614, 411	10, 700, 743	9, 279, 469	9, 251, 344
Sand and sandstone (ground)	do	(3)	(3)	(3)	(3)	(3)	(3)
Silica (quartz)	do	(3)	(3)	(3)	(3)	------------	------------
Silver [5]	troy ounces	15, 016	10, 678	15, 501	11, 023	13, 095	9, 312
Slate		------------	3, 464, 348	------------	2, 606, 799	------------	1, 836, 925
Soapstone	short tons	(3)	(3)	(3)	(3)	(3)	(3)
Stone	do	[7] 23, 506, 540	[7] 25, 013, 400	[7] 23, 131, 670	[7] 26, 892, 960	[7] 19, 999, 570	[7] 23, 566, 298

Sulfuric acid (60° Baumé)[8]	do	351,722	[4] 2,986,120	364,952	[4] 3,448,796	357,992	[4] 3,425,983
Tripoli (rottenstone)	do	(3)	(3)	(3)	(3)	(3)	(3)
Miscellaneous[9]			21,065,116		137,107,865		143,559,521
Total value, eliminating duplications			737,143,530		841,847,147		889,156,000

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[1] Exclusive of natural cement, value for which is included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value included under "Miscellaneous."

[4] Value not included in total value for State.

[5] Copper, gold, and silver were recovered from magnetite-pyrite-chalcopyrite ore, which is included as iron ore produced. Bureau of Mines not at liberty to publish figures.

[6] No canvass.

[7] Exclusive of marble in 1941 and of dimension basalt in 1942 and 1943, value for which is included under "Miscellaneous."

[8] From zinc smelting.

[9] Includes minerals indicated by "1," "3," and "7" above.

RHODE ISLAND

Clay products (other than pottery and refractories)			(1 2)		(1 2)		(1 2)
Coke	short tons	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Graphite, amorphous	do			(1)	(1)	(1)	(1)
Lime	do	(1)	(1)	(1)	(1)		
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel	short tons	649,289	$459,223	572,437	$361,881	356,043	$327,750
Stone	do	212,580	493,715	191,420	351,664	171,230	410,478
Miscellaneous[5]			2,142,417		2,555,107		2,582,906
Total value, eliminating duplications			1,133,400		836,040		808,000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Includes minerals indicated by "1" above.

SOUTH CAROLINA

Barite	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $1,860,000		[2] $1,600,000		[2] $1,200,000
Raw (sold by producers)	short tons	181,322	1,604,047	118,055	979,699	116,458	965,153
Copper	pounds	1,000	118	1,000	121	1,000	130
Corundum	short tons					(1)	(1)
Ferro-alloys	do			(1 3)	(1 3)	(1 3)	(1 3)
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	15,508	542,780	7,824	273,840	147	5,145
Manganese ore	short tons					(1)	(1)
Manganiferous ore	do					(1)	(1)
Mica:							
Scrap	do	(1)	(1)	(1)	(1)	(1)	(1)
Sheet	pounds	(1)	(1)	(1)	(1)	(1)	(1)

See footnotes at end of State table.

Mineral products of the United States, 1941–43, by States—Continued

SOUTH CAROLINA—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Ore (dry and siliceous) (gold and silver)	short tons	135,288	(5)	86,270	(5)	156	(5)
Sand and gravel	do	1,125,725	$611,469	729,543	$355,170	452,166	$217,280
Silver	troy ounces	6,525	4,640	5,064	3,601	135	96
Stone	short tons	2,055,090	2,574,797	2,040,610	2,624,284	[6] 1,615,730	[6] 1,804,196
Topaz, industrial	do	(1)	(1)	(1)	(1)	(1)	(1)
Vermiculite	do			(1)	(1)	(1)	(1)
Miscellaneous [7]			47,762		4,363,821		4,643,022
Total value, eliminating duplications			7,245,613		5,890,982		4,759,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Exclusive of dimension granite, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1" and "4" above.

SOUTH DAKOTA

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Beryllium ore	short tons	151	$7,067	(1)	(1)	(1)	(1)
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			(1 2)		(1 2)		(1 2)
Raw (sold by producers)	short tons	57,139	401,758	88,149	$664,449	124,528	$822,264
Coal	do	70,825	108,000	53,538	104,000	43,000	81,000
Copper	pounds			2,000	242		
Feldspar (crude)	long tons	59,015	170,723	64,842	225,410	70,913	342,643
Gems and precious stones			(3)		(3)		(3)
Gold	troy ounces	600,637	21,022,295	522,098	18,273,430	106,444	3,725,540
Gypsum (crude)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore sold for paint	long tons	2,150	(1)			1,678	(1)
Lead	short tons			85	11,390	41	6,150
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals	do	3,636	76,775	4,964	169,182	5,452	200,194
Manganese ore	do			(1)	(1)	(1)	(1)
Mica:							
Scrap	do	1,611	27,616	(1)	(1)	(1)	(1)
Sheet	pounds	298,693	37,925	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Natural gas	M cubic feet	7,000	2,000	7,000	2,000	7,000	2,000

Ores (crude), etc.:							
Dry and siliceous (gold and silver)	short tons	1,711,744	(4)	1,454,387	(4)	202,018	(4)
Zinc-lead	do			9,997	(4)	2,914	(4)
Sand and gravel	do	2,627,059	559,766	3,577,983	1,443,908	2,291,450	701,034
Silver	troy ounces	170,771	121,437	186,937	132,933	35,886	25,519
Stone	short tons	[5] 401,550	[5] 1,189,564	714,750	1,763,790	[5] 269,410	[5] 1,304,370
Tantalum and columbium ores	pounds			(1)	(1)	(1)	(1)
Tin (metallic equivalent)	short tons	2	(1)	(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates)	do	(1)	(1)				
Zinc	do			115	21,390	46	9,936
Miscellaneous [6]			776,770		1,327,159		1,390,354
Total value, eliminating duplications			24,501,696		24,139,283		8,611,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Not valued as ore; value of recoverable metal content included under the metals.

[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[6] Includes minerals indicated by "1" and "4" above.

TENNESSEE

Aluminum	short tons	104,662	[1] $34,016,009	(1 2)	(1 2)	(1 2)	(1 2)
Barite	do	104,511	779,565	83,291	$624,584	52,593	$383,007
Cement	barrels	5,623,800	8,520,284	6,407,196	9,927,895	4,579,526	7,342,894
Clay:							
Products (other than pottery and refractories)			[3] 2,401,000		[3] 1,800,000		[3] 1,800,000
Raw (sold by producers)	short tons	159,304	832,507	145,321	814,771	129,176	740,707
Coal	do	7,045,271	16,454,539	8,158,237	20,690,859	7,160,000	20,907,000
Coke	do	150,393	[1] 1,118,725	307,070	(1 2)	303,072	(1 2)
Copper	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Ferro-alloys	short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Flint lining for tube mills	do	(2)	(2)				
Fluorspar	do			114	(2)	57	(2)
Fuller's earth	do	(2)	(2)			(2)	(2)
Gold	troy ounces	227	7,945	159	5,565	303	10,605
Iron:							
Ore (sinter from copper-iron ore)	long tons	(2)	(2)	(2)	(2)	(2)	(2)
Pig	short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Lead	do	23	2,622	238	31,892	200	30,000
Lime	do	239,528	1,354,642	269,566	1,620,585	235,854	1,503,850
Manganese ore	do	4,426	86,191	(2)	(2)	(2)	(2)
Manganiferous ore	do	1,865	12,229	(2)	(2)	(2)	(2)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	10,000	5,000	10,000	4,000	18,000	7,000
Ores (crude), etc.:							
Copper	short tons	732,114	(5)	823,595	(5)	1,019,080	(5)
Lead	do	469	(5)	4,627	(5)	2,666	(5)
Zinc	do	1,300,347	(5)	1,551,832	(5)	1,486,365	(5)
Zinc-lead	do	100	(5)	3,800	(5)	17,674	(5)
Petroleum	barrels	12,000	15,000	9,000	9,000	10,000	(2)
Phosphate rock	long tons	(2)	(2)	(2)	(2)	(2)	(2)

See footnotes at end of State table.

Mineral products of the United States, 1941–43, by States—Continued

TENNESSEE—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Pyrites	long tons	(2)	(2)	(2)	(2)	(2)	(2)
Sand and gravel	short tons	4,811,686	$2,829,836	[6] 3,550,427	[6] $3,086,499	2,922,752	$2,285,339
Silica (quartz)	do	(2)	(2)	(2)	(2)	(2)	(2)
Silver	troy ounces	39,161	27,848	34,671	24,655	52,058	37,019
Stone	short tons	7,896,970	9,157,673	7,716,540	9,018,272	8,280,320	10,047,944
Strontium minerals	do					(2)	(2)
Sulfuric acid [7]	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Zinc	do	36,170	5,425,500	43,971	8,178,606	41,766	9,021,456
Miscellaneous [8]			17,739,915		72,864,545		76,786,593
Total value, eliminating duplications			56,301,592		67,223,639		65,053,000

[1] Value not included in total value for State.

[2] Value included under "Miscellaneous."

[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."

[7] From copper smelting.

[8] Includes minerals indicated by "2" and "6" above.

TEXAS

Product		1941 Quantity	1941 Value	1942 Quantity	1942 Value	1943 Quantity	1943 Value
Asphalt (native)	short tons	294,170	$550,206	(1)	(1)	(1)	(1)
Barite	do	(1)	(1)				
Bromine	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	9,842,260	16,362,293	12,139,800	$20,942,867	9,177,392	$15,635,708
Chromite	short tons					(1)	(1)
Clay:							
Products (other than pottery and refractories)			[3] 4,121,000		[3] 3,000,000		[3] 3,000,000
Raw (sold by producers)	short tons	137,937	331,873	203,355	401,504	205,599	497,773
Coal:							
Bituminous	do	15,482	52,730	13,210	55,076	23,000	99,000
Lignite	do	337,326	284,000	290,969	246,000	144,000	127,000
Copper	pounds	12,000	1,416	198,000	23,958	162,000	21,060
Feldspar (crude)	long tons	(1)	(1)	(1)	(1)	(1)	(1)
Flint lining for tube mills	short tons	(1)	(1)				
Fluorspar	do	(1)	(1)	(1)	(1)	960	19,281
Fuller's earth	do	77,033	713,085	85,012	712,303	94,137	728,141
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	306	10,710	236	8,260	4	140

Graphite, crystalline	pounds	------	------	(1)	(1)	(1)	(1)
Gypsum (crude)	short tons	446,419	467,087	414,196	496,669	394,841	519,541
Helium	cubic feet	[4] 16,173,430	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Iron ore	long tons	(1)	(1)	(1)	(1)	7,334	(1)
Lead	short tons	186	21,204	181	24,254	13	1,950
Lime	do	77,783	632,099	67,377	559,279	132,167	1,034,355
Magnesite	do	8,900	44,500	(1)	(1)	(1)	(1)
Magnesium	do	6,564	3,150,822	(1)	(1)	(1)	(1)
Magnesium compounds (natural)	pounds	(1)	(1)	(1)	(1)	647,496,000	10,778,617
Manganiferous ore	short tons	------	------	(1)	(1)	------	------
Mercury	flasks (76 pounds)	(1)	(1)	(1)	(1)	1,769	345,326
Mica:							
Scrap	short tons	------	------	------	------	(1)	(1)
Sheet	pounds	------	------	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Natural gas	M cubic feet	1,086,312,000	162,344,000	1,170,345,000	182,660,000	1,320,000,000	208,560,000
Natural gasoline and allied products:							
Natural gasoline and cycle products	gallons	1,180,221,000	44,066,000	1,207,901,000	43,472,000	1,192,526,000	51,930,000
Liquefied petroleum gases	do	378,598,000	4,416,000	359,929,000	6,832,000	477,604,000	11,126,000
Ores (crude), etc.:							
Copper	short tons	58	(5)	506	(5)	339	(5)
Dry and siliceous (gold and silver)	do	140,739	(5)	100,052	(5)	3,640	(5)
Lead	do	21	(5)	140	(5)	155	(5)
Peat	do	------	------	------	------	(1)	(1)
Pebbles for grinding	do	(1)	(1)	(1)	(1)	5,341	61,799
Petroleum	barrels	505,572,000	568,000,000	483,097,000	564,400,000	593,520,000	721,400,000
Pumice	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Salt (sodium chloride)	do	656,569	1,713,508	821,111	2,202,527	1,127,854	3,610,532
Sand and gravel	do	12,134,312	6,681,277	17,727,971	11,639,412	12,679,989	8,523,820
Silica (quartz)	do	1,485	14,345	319	3,190	------	------
Silver	troy ounces	1,096,027	779,397	672,781	478,422	10,284	7,313
Sodium sulfate (natural)	short tons	75,029	957,354	75,032	1,008,286	(1)	(1)
Stone	do	3,497,720	2,908,364	3,772,040	3,658,802	2,698,220	2,534,271
Strontium minerals	do	1,959	31,294	1,917	19,185	4,958	62,137
Sulfur	long tons	2,842,988	45,487,808	2,579,739	41,275,824	2,385,909	38,174,544
Sulfuric acid [6]	short tons	------	------	(1 7)	(1 7)	(1 7)	(1 7)
Sulfur ore	long tons	300	1,500	1,500	15,000	2,500	25,000
Tripoli	short tons	(1)	(1)	------	------	------	------
Tungsten ore (60-percent concentrates)	do	------	------	(1)	(1)	------	------
Vermiculite	do	------	------	------	------	199	1,990
Miscellaneous [8]		------	3,938,818	------	25,164,782	------	37,761,421
Total value, eliminating duplications		------	868,082,690	------	909,203,286	------	1,116,056,000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Figures cover fiscal year ended June 30 of year stated.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] From zinc smelting.

[7] Value not included in total value for State.

[8] Includes minerals indicated by "1" above.

Mineral products of the United States, 1941–43, by States—Continued

UTAH

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore (concentrates) ..... short tons					(1)	(1)
Arsenious oxide ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Asphalt (native) ..... do	36,476	$856,966	40,078	$912,163	76,987	$1,390,485
Bismuth ..... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Bitumen, natural sulfonated ..... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement ..... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[3] 758,000		[3] 1,000,000		[3] 1,000,000
Raw (sold by producers) ..... short tons	25,366	54,019	29,359	57,395	17,905	43,465
Coal ..... do	4,076,779	9,509,973	5,516,849	14,271,221	5,770,000	16,733,000
Coke ..... do	246,851	(1 4)	264,933	(1 4)	324,829	(1 4)
Copper ..... pounds	533,676,000	62,973,768	613,382,000	74,219,222	647,978,000	84,237,140
Fluorspar ..... short tons	748	(1)	1,018	(1)	51	(1)
Fuller's earth ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		(5)		(5)		(5)
Gold ..... troy ounces	356,501	12,477,535	391,544	13,704,040	390,470	13,666,450
Gypsum (crude) ..... short tons	61,813	78,147	48,574	60,259	(1)	(1)
Iron:						
Ore ..... long tons	355,006	(1)	319,834	(1)	911,839	(1)
Pig ..... short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Lead ..... do	69,601	7,934,514	71,930	9,638,620	65,257	9,788,550
Lime ..... do	56,221	352,306	57,609	392,912	59,811	407,753
Magnesite ..... do	50	400				
Manganese ore ..... do	43	(1)	(1)	(1)	(1)	(1)
Manganiferous ore ..... do	551	2,940	(1)	(1)	(1)	(1)
Mercury ..... flasks (76 pounds)	19	3,515	(1)	(1)		
Molybdenum ..... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas ..... M cubic feet	5,562,000	1,145,000	5,163,000	1,079,000	4,600,000	966,000
Natural gasoline ..... gallons	808,000	45,000	775,000	39,000		
Ores (crude), etc.:						
Copper ..... short tons	30,444,402	(6)	33,611,061	(6)	35,999,656	(6)
Dry and siliceous (gold and silver) ..... do	622,650	(6)	434,234	(6)	352,475	(6)
Lead ..... do	77,979	(6)	75,758	(6)	48,658	(6)
Lead-copper ..... do	5,276	(6)	41	(6)	53	(6)
Zinc ..... do	2,302	(6)	16,710	(6)	231,845	(6)
Zinc-lead ..... do	798,864	(6)	841,837	(6)	753,930	(6)
Zinc-lead-copper ..... do	1,344	(6)	2,014	(6)	114	(6)
Petroleum ..... barrels	4,000	4,000				
Phosphate rock ..... long tons	1,340	8,535	1,184	7,410		
Potassium salts ..... short tons	(1)	(1)	17,274	340,125	(1)	(1)
Salt (sodium chloride) ..... do	107,079	196,413	110,871	290,040	169,810	562,293

Sand and gravel	do	2,760,026	935,371	3,874,841	2,079,302	2,536,518	1,322,544
Silver	troy ounces	11,395,485	8,103,456	10,574,955	7,519,968	9,479,340	6,740,864
Sodium sulfate (natural)	short tons	(1)	(1)				
Stone	do	408,140	340,551	285,170	318,261	390,480	416,821
Sulfur	long tons			(1)	(1)		
Sulfuric acid [7]	short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Tungsten ore (60-percent concentrates)	do	30	40,911	(1)	(1)	(1)	(1)
Vanadium	pounds	119,331	(1)	(1)	(1)	(1)	(1)
Zinc	short tons	42,049	6,307,350	45,543	8,470,998	46,896	10,129,536
Miscellaneous [8]			16,048,855		18,136,720		21,036,047
Total value, eliminating duplications			122,386,873		147,073,924		160,935,000

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[1] Value included under "Miscellaneous."
[2] Figures not available.
[3] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] From copper smelting.
[8] Includes minerals indicated by "1" above.

VERMONT

Asbestos	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			(1 2)		(1 2)		(1 2)
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cobalt	pounds	1,399	(1)				
Copper	do					580,000	$75,400
Garnet, abrasive	short tons	(1)	(1)				
Gold	troy ounces					17	595
Lime	short tons	67,824	$479,219	71,642	$462,908	51,011	357,265
Mica, scrap	do	(1)	(1)	(1)	(1)		
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Nickel	short tons	6	(1)				
Ores (crude), etc.: Copper	do					17,046	(4)
Sand and gravel	do	[5] 601,918	[5] 127,149	476,331	173,258	227,618	101,918
Silver	troy ounces					2,721	1,935
Slate			1,921,923		1,659,789		1,284,288
Stone	short tons	185,840	4,190,112	244,110	3,831,399	154,170	3,779,673
Talc	do	57,248	663,468	58,695	659,314	56,458	658,471
Miscellaneous [6]			749,799		479,421		144,038
Total value, eliminating duplications			8,131,670		7,266,089		6,404,000

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[1] Value included under "Miscellaneous."
[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[3] No canvass.
[4] Not valued as ore; value of recoverable metal content included under the metals.
[5] "Government-and-contractor." Value of "Commercial" included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral products of the United States, 1941–43, by States—Continued

VIRGINIA

Product	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Aplite (crude)……long tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite……short tons	(1)	(1)	(1)	(1)	------	------
Bauxite……do	(1)	(1)	(1)	(1)	(1)	(1)
Beryllium ore……do	------	------	------	------	(1)	(1)
Cement……barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	------	[2] $3,369,000	------	[2] $2,500,000	------	[2] $1,600,000
Raw (sold by producers)……short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coal……do	18,440,946	42,917,454	20,136,179	52,079,249	19,500,000	56,160,000
Coke……do	324,573	[3] 1,922,181	350,521	[3] 2,281,289	293,324	[3] 2,051,662
Copper……pounds	------	------	55,000	6,655	200,000	26,000
Feldspar (crude)……long tons	(1)	(1)	24,298	140,304	20,550	122,957
Ferro-alloys……short tons	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Gems and precious stones	------	(4)	------	(4)	------	(4)
Gold……troy ounces	240	8,400	109	3,815	50	1,750
Gypsum (crude)……short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron:						
Ore……long tons	331	(1)	10,174	(1)	7,490	(1)
Pig……short tons	(1 3)	(1 3)	(1 3)	(1 3)	------	------
Kyanite……do	5,461	116,952	5,592	116,683	(1)	(1)
Lead……do	3,390	386,460	1,803	241,602	2,288	343,200
Lime……do	224,293	1,359,281	206,420	1,367,043	194,974	1,338,675
Manganese ore……do	6,091	125,163	(1)	(1)	(1)	(1)
Manganiferous ore……do	4,375	33,635	(1)	(1)	(1)	(1)
Marl, calcareous……do	24,113	23,169	25,752	27,828	61,724	73,698
Mica:						
Scrap……do	(1)	(1)	(1)	(1)	(1)	(1)
Sheet……pounds	(1)	(1)	(1)	(1)	(1)	(1)
Millstones	------	(1)	------	(1)	------	(1)
Mineral waters……gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas……M cubic feet	106,000	94,000	92,000	86,000	84,000	80,000
Ores (crude), etc.:						
Copper……short tons	------	------	46	(5)	------	------
Dry and siliceous (gold and silver)……do	540	(5)	100	(5)	------	------
Zinc……do	35	(5)	708	(5)	35	(5)
Zinc-lead……do	501,555	(5)	462,127	(5)	528,016	(5)
Petroleum……barrels	------	------	------	------	2,000	(1)
Phosphate rock……long tons	(1)	(1)	(1)	(1)	(1)	(1)
Pyrites……do	(1)	(1)	(1)	(1)	(1)	(1)
Quartz crystal……pounds	------	------	------	------	(1)	(1)

Salt	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	4,593,193	3,770,650	5,610,753	5,460,232	4,668,706	4,775,985
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	--------	--------	(1)	(1)	(1)	(1)
Silver	troy ounces	135	96	1,793	1,275	14,947	10,629
Slate		--------	(1)	--------	(1)	--------	260,864
Stone [6]	short tons	9,195,450	9,586,541	7,052,930	7,938,383	5,668,090	6,615,944
Talc and ground soapstone [6]	do	(1)	(1)	(1)	(1)	(1)	(1)
Titanium concentrates:							
Ilmenite	do	(1)	(1)	(1)	(1)	(1)	(1)
Rutile	do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc	do	22,913	3,436,950	15,991	2,974,326	18,603	4,018,248
Miscellaneous [7]		--------	11,924,924	--------	12,405,788	--------	12,477,819
Total value, eliminating duplications		--------	71,340,934	--------	79,770,810	--------	82,068,000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Soapstone used as dimension stone included in figures for stone.

[7] Includes minerals indicated by "1" above.

WASHINGTON

Aluminum	short tons	67,410	[1] $21,897,854	(1 2)	(1 2)	(1 2)	(1 2)
Antimony ore (concentrates)	do	64	(2)	(2)	(2)	--------	--------
Arsenious oxide	do	(3)	(3)	(3)	(3)	(3)	(3)
Cement	barrels	(2)	(2)	(2)	(2)	(2)	(2)
Chromite	short tons	--------	--------	(2)	(2)	--------	--------
Clay:							
Products (other than pottery and refractories)		--------	[4] 1,132,000	--------	[4] $900,000	--------	[4] $900,000
Raw (sold by producers)	short tons	81,534	103,737	84,966	121,735	99,367	126,751
Coal	do	1,841,274	6,478,674	1,953,209	7,549,352	1,526,000	6,684,000
Coke	do	--------	--------	--------	--------	14,853	(1 2)
Copper	pounds	17,372,000	2,049,896	16,060,000	1,943,260	14,630,000	1,901,900
Diatomite	short tons	(2)	(2)	(2)	(2)	(2)	(2)
Ferro-alloys	do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Fluorspar	do	104	(2)	48	(2)	--------	--------
Gems and precious stones		--------	(5)	--------	(5)	--------	(5)
Gold	troy ounces	84,176	2,946,160	75,396	2,638,860	65,244	2,283,540
Graphite, crystalline	pounds	(2)	(2)	--------	--------	--------	--------
Iron ore	long tons	6,492	(2)	11,851	(2)	13,455	(2)
Lead	short tons	3,903	444,942	4,851	650,034	5,022	753,300
Lime	do	62,309	656,363	55,864	623,766	(2)	(2)
Magnesite	do	(2)	(2)	(2)	(2)	(2)	(2)
Magnesium	do	--------	--------	--------	--------	(2)	(2)
Magnesium sulfate (natural)	pounds	--------	--------	(2)	(2)	358,000	10,000
Manganese ore	short tons	1,588	(2)	(2)	(2)	(2)	(2)
Manganiferous ore	do	7	(2)	--------	--------	--------	--------
Mercury	flasks (76 pounds)	(2)	(2)	(2)	(2)	--------	--------

See footnotes at end of State table.

Mineral products of the United States, 1941–43, by States—Continued

WASHINGTON—Continued

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas	M cubic feet	1,000	$2,000				
Ores (crude), etc.:							
Copper	short tons	694,565	(6)	717,124	(6)	2,339	(6)
Dry and siliceous (gold and silver)	do	180,700	(6)	93,957	(6)	61,220	(6)
Lead	do	152	(6)	161	(6)	374	(6)
Lead-copper	do			5	(6)		
Zinc	do					19,412	(6)
Zinc-copper	do					720,560	(6)
Zinc-lead	do	363,092	(6)	411,690	(6)	327,376	(6)
Peat	do	(2)	(2)	(2)	(2)	(2)	(2)
Pulpstones	do	150	16,065	194	$9,985	63	$4,148
Pumice	do					700	7,362
Quartz crystal	pounds					(2)	(2)
Sand and gravel	short tons	5,583,285	2,476,834	8,172,550	4,094,900	[7] 5,183,374	[7] 3,403,720
Sand and sandstone (ground)	do			(2)	(2)	3,902	25,485
Silica (quartz)	do			(2)	(2)	(2)	(2)
Silver	troy ounces	402,030	285,888	369,038	262,427	370,440	263,424
Sodium sulfate (natural)	short tons			(2)	(2)		
Stone	do	2,148,970	1,757,873	1,965,820	1,809,757	2,081,810	2,499,550
Strontium minerals	do	(2)	(2)	(2)	(2)		
Talc and ground soapstone	do	6	2,426	7	2,864	1,998	11,822
Tungsten ore (60-percent concentrates)	do	68	(2)	(2)	(2)	(2)	(2)
Zinc	do	14,320	2,148,000	14,398	2,678,028	12,203	2,635,848
Miscellaneous [8]			8,764,024		56,450,225		83,769,501
Total value, eliminating duplications			28,506,882		35,659,543		37,547,000

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[1] Value not included in total value for State.
[2] Value included under "Miscellaneous."
[3] Figures not available.
[4] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[8] Includes minerals indicated by "2" and "7" above.

WEST VIRGINIA

Bromine	pounds	1, 048, 178	$206, 768	(1)	(1)	1, 002, 808	$95, 391
Calcium chloride	short tons	13, 234	71, 832	(1)	(1)	16, 144	53, 244
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)		----------	[2] 3, 180, 000	----------	[2] $2, 000, 000	----------	[2] 1, 600, 000
Raw (sold by producers)	short tons	70, 885	133, 300	74, 141	146, 245	68, 564	138, 304
Coal	do	140, 250, 248	313, 255, 559	155, 881, 497	377, 272, 975	159, 620, 000	450, 128, 000
Coke	do	2, 245, 307	[3] 7, 626, 823	2, 779, 589	[3] 11, 169, 657	3, 035, 376	[3] 13, 513, 440
Ferro-alloys	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Grindstones and pulpstones	do	2, 090	102, 562	1, 957	113, 988	2, 172	102, 098
Iron, pig	do	1, 032, 148	(1 3)	1, 417, 225	(1 3)	1, 335, 331	(1 3)
Lime	do	372, 677	2, 350, 362	422, 481	2, 879, 509	492, 292	3, 401, 706
Magnesium chloride (natural)	pounds	(1)	(1)	(1)	(1)	----------	----------
Manganese ore	short tons	2, 464	(1)	(1)	(1)	----------	----------
Manganiferous ore	do	448	(1)	(1)	(1)	----------	----------
Marl, calcareous	do	(1)	(1)	(1)	(1)	(1)	(1)
Millstones		----------	(1)	----------	----------	----------	----------
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	207, 681, 000	81, 957, 000	215, 193, 000	87, 357, 000	195, 000, 000	80, 930, 000
Natural gasoline and allied products:							
Natural gasoline	gallons	65, 873, 000	2, 717, 000	67, 987, 000	2, 817, 000	66, 804, 000	3, 207, 000
Liquefied petroleum gases	do	32, 171, 000	1, 354, 000	33, 841, 000	1, 548, 000	31, 724, 000	1, 967, 000
Petroleum	barrels	3, 433, 000	7, 390, 000	3, 574, 000	9, 040, 000	3, 349, 000	8, 700, 000
Rubbing stones	short tons	(1)	(1)	----------	----------	----------	----------
Salt	do	143, 780	792, 104	140, 216	822, 794	230, 329	923, 499
Sand and gravel	do	2, 733, 607	3, 185, 639	3, 058, 878	3, 747, 351	2, 654, 434	3, 596, 006
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Stone	do	[5] 4, 547, 200	[5] 5, 988, 840	3, 223, 330	3, 238, 008	[5] 3, 157, 190	[5] 3, 324, 912
Sulfuric acid [6]	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Miscellaneous [7]		----------	48, 275, 238	----------	46, 489, 570	----------	49, 773, 792
Total value, eliminating duplications		----------	425, 626, 303	----------	493, 994, 630	----------	560, 330, 000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State.

[4] No canvass.

[5] Exclusive of dimension sandstone in 1941 and of dimension limestone in 1943, value for which is included under "Miscellaneous."

[6] From zinc smelting.

[7] Includes minerals indicated by "1" and "3" above

Mineral products of the United States, 1941–43, by States—Continued

WISCONSIN

Product		1941		1942		1943	
		Quantity	Value	Quantity	Value	Quantity	Value
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $578,000		[2] $400,000		[2] $330,000
Raw (sold by producers)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coke	do	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Flint lining for tube mills	do			(1)	(1)	(1)	(1)
Iron ore	long tons	1,486,776	3,998,287	1,548,294	3,936,590	1,392,173	3,822,025
Lead	short tons	1,225	139,650	775	103,850	920	138,000
Lime	do	79,077	659,324	63,801	499,279	82,913	633,399
Marl, calcareous	do	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Ores (crude), etc.:							
Zinc	short tons	157,068	(5)	93,642	(5)	216,959	(5)
Zinc-lead	do	54,905	(5)	208,032	(5)	331,063	(5)
Peat	do	(1)	(1)	(1)	(1)	(1)	(1)
Pebbles for grinding	do	(1)	(1)	(1)	(1)	(1)	(1)
Pyrites	long tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	short tons	9,263,237	3,398,039	9,265,512	3,496,621	6,223,375	2,595,531
Sand and sandstone (ground)	do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)	do	(1)	(1)	(1)	(1)	(1)	(1)
Stone	do	4,376,720	5,666,120	4,492,740	6,309,369	[6] 4,186,140	[6] 6,677,382
Zinc	do	6,238	935,700	9,426	1,753,236	14,387	3,107,592
Miscellaneous [7]			6,830,786		7,068,578		7,277,517
Total value, eliminating duplications			17,020,722		17,998,036		18,925,000

[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] Value not included in total value for State

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] Exclusive of basalt, value for which is included under "Miscellaneous."

[7] Includes minerals indicated by "1" and "4" above.

WYOMING

Beryllium ore	short tons	(1)	(1)				
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $194,000		(1 2)		(1 2)
Raw (sold by producers)	short tons	145,574	1,369,057	139,410	$1,259,863	159,252	$1,389,644
Coal	do	6,646,330	13,916,228	8,133,225	17,927,061	9,110,000	20,953,000
Copper	pounds	8,000	944				
Feldspar (crude)	long tons	11,846	43,484	13,953	50,730	(1)	(1)
Gems and precious stones			(3)		(3)		(3)
Gold	troy ounces	478	16,730	23	805		
Gypsum (crude)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore	long tons	985,852	(1)	957,027	(1)	814,203	(1)
Lead	short tons			3	402		
Manganese ore	do					(1)	(1)
Mica:							
Scrap	do	(1)	(1)			(1)	(1)
Sheet	pounds					(1)	(1)
Mineral waters	gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Natural gas	M cubic feet	29,284,000	5,687,000	33,124,000	6,507,000	35,500,000	6,993,000
Natural gasoline and allied products:							
Natural gasoline	gallons	33,920,000	1,876,000	32,699,000	1,636,000	30,780,000	1,601,000
Liquefied petroleum gases	do	1,560,000	62,000	2,538,000	104,000	3,057,000	138,000
Ores (crude), etc.:							
Copper	short tons	42	(4)				
Dry and siliceous (gold and silver)	do	117	(4)	59	(4)		
Lead	do			25	(4)		
Petroleum	barrels	29,878,000	25,700,000	32,812,000	29,000,000	33,077,000	32,400,000
Sand and gravel	short tons	2,003,663	840,933	3,978,673	1,613,407	2,224,941	978,460
Silver	troy ounces	94	67	52	37		
Sodium salts (carbonates and sulfates) (natural)	short tons	(1)	(1)	9,214	94,308	(1)	(1)
Stone	do	838,050	737,455	179,290	207,122	259,360	197,641
Tantalum and columbium ores	pounds	250	219				
Vermiculite	short tons	(1)	(1)	1,060	10,450		
Miscellaneous [5]			2,307,237		5,659,312		4,012,765
Total value, eliminating duplications			52,751,354		64,070,497		68,664,000

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[1] Value included under "Miscellaneous."

[2] Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products.

[3] No canvass.

[4] Not valued as ore; value of recoverable metal content included under the metals.

[5] Includes minerals indicated by "1" above.

PART II. METALS

GOLD AND SILVER

By C. E. Needham

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GENERAL SUMMARY

The sharp decline in gold output so evident in 1942 continued at an accelerated rate in 1943, and production in the United States fell to the lowest figure since gold was discovered in California in 1848. Under permits from the War Production Board a few large companies operated on a restricted basis until June, after which gold mining as such almost ceased. As a result, about 55 percent of the 1943 output was produced before July and only 45 percent thereafter.

The decline in gold mining was general all over the world, and output was estimated to be 15 percent below that of 1942. Output in North America was reduced 37 percent, distributed as follows: United States 61 percent, Canada 25 percent, and Mexico 21 percent; Newfoundland reported an increase of 19 percent. South American output is estimated to have decreased about 17 percent. South African production held up well and dropped only 9 percent from 1942.

As in 1942, silver output in the United States was sustained at a substantial figure because of high base-metal production; the decline from 1942 was 24 percent. Output in Canada was 17 percent below that for 1942. Mexican production increased nearly 2 percent.

Salient statistics of gold and silver in the United States,[1] *1925–29 (average) and 1940–43*

	Average (1925–29)	1940	1941	1942	1943
Mine production, ounces:					
Gold	2,170,798	4,869,949	4,750,865	3,457,110	1,363,815
Silver	61,511,087	70,549,362	67,258,997	54,090,765	41,460,826
Number of mines producing gold and silver:					
Lode	2,187	5,393	4,542	2,619	1,394
Placer	1,243	4,176	3,349	1,758	362
Ore (dry and siliceous) produced, short tons:					
Gold ore	7,014,646	16,550,095	15,117,117	9,487,907	3,766,149
Gold-silver ore	597,075	948,171	1,447,371	1,163,970	553,566
Silver ore	799,061	1,201,469	1,074,543	996,823	643,271
Percentage derived from—					
Dry and siliceous ores:					
Gold	57	56	54	50	38
Silver	21	41	41	37	26
Base metal ores:					
Gold	23	13	14	21	50
Silver	79	58	59	62	74
Placers:					
Gold	20	31	31	29	12
Silver	(2)	(2)	(2)	(2)	(2)
Net industrial consumption:					
Gold	$27,938,073	$13,306,032	$37,001,620	$47,294,810	$86,343,353
Silver, ounces	28,747,779	44,498,903	72,432,318	101,398,695	129,940,686
Imports:					
Gold	$201,971,673	$4,749,467,203	$982,442,027	$315,779,716	$101,792,745
Silver	$64,264,486	$58,433,866	$47,053,413	$41,103,149	$27,902,960
Exports:					
Gold	$251,428,995	$4,994,899	$64,280	$102,126	$32,854,590
Silver	$87,559,828	$3,674,385	$5,673,361	$1,999,490	$30,689,397
Monetary stocks:					
Gold	$4,339,000,000	$21,995,000,000	$22,737,000,000	$22,726,000,000	$21,938,000,000
Silver, ounces	1,417,000,000	3,135,000,000	3,280,000,000	3,334,000,000	3,254,000,000
Price, average, per ounce:					
Gold	$20.67+	$35.00	$35.00	$35.00	$35.00
Silver	$0.600+	$0.711+	$0.711+	$0.711+	$0.711+
World production, ounces:					
Gold	18,988,557	42,012,000	40,766,000	35,519,000	29,659,000
Silver	254,377,085	274,161,000	259,782,000	245,792,000	227,325,000

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[1] Philippine Islands and Puerto Rico excluded.

[2] Less than 0.5 percent.

REGULATIONS

Gold.—Regulations and legislative proposals on gold were few in 1943. Holding that many gold miners were without funds to continue their payments under contract and to meet past and present tax obligations, Senator James E. Murray of Montana in May introduced a bill (S. 344) containing provisions that would permit owners and operators of gold mines closed by Limitation Order L–208 to petition the courts for relief and would direct the Reconstruction Finance Corporation to make loans to maintain the properties and equipment.

Silver.—New regulations on silver were few and for the most part not of outstanding significance in 1943. The price and allocation of the metal continued under Government control, with features not greatly changed from 1942. Early in the year bills were introduced by Senators Theodore Green (Rhode Island), Abe Murdock (Utah), and Pat McCarran (Nevada) providing for the disposal of silver from Treasury stocks.

The Green bill in final form was signed by the President on July 12, 1943. Briefly, this legislation made possible the release of silver from Treasury stocks for domestic consumption for use in, but not limited to, the making of munitions of war and the supplying of civilian needs, as well as the conversion of existing plants to these purposes. It may be sold at not less than 71.11 cents per ounce, and it may be leased under such terms as the Secretary of the Treasury may deem advisable.

On March 23 the Office of Price Administration permitted an increase of 36 cents per ounce of silver contained in about a dozen specified lines of finished silverware because the silversmiths must use domestic silver priced at 71.11 cents rather than imported silver at lower cost.

War Production Board Order M–199 (the basic silver conservation order issued in July 1942) was amended three times in 1943—first, on February 25, whereby, except for filling orders having a preference rating of A–1–a or higher, manufacturers were to receive but half of their 1941 or 1942 consumption of domestic silver, whichever amount was higher; second, on May 10, under which the quotas were changed from a monthly to a quarterly basis and certain further restrictions were made in the use of silver for nonessential purposes; and third, on July 29 following the passage of the Green bill, whereby Treasury silver was added to the list and limited to the manufacture of engine bearings, official military insignia, brazing alloys, and solders, whereas foreign silver was restricted to medical use, the photographic industry, and certain uses carrying ratings of AA–5 or higher.

MONETARY CONSIDERATIONS

Among the numerous post-war problems that received serious attention in 1943, one of vital importance was the question of a stable currency to facilitate the restoration and expansion of international trade. Naturally, much of the discussion centered around gold.

Many held that the gold standard of the period before World War I had little or no chance of being restored. On the other hand, sentiment was freely expressed in many circles that gold under some plan would be the logical standard of value and medium of exchange for international purposes. The position was taken that gold is the one medium of exchange that inhabitants of all nations will accept and that it is effective when other forms of money fail; that many countries have their economies so closely linked with gold mining that demonetization of the metal would result in very serious economic disturbances, or even ruin; and that if the Allied Nations are to function as well in peace as they have in war, they must all be anchored to a common stable currency.

Plans for establishing an international monetary standard were proposed by United States, British, Canadian, and French experts. The American plan favored an actual gold fund of $5,000,000,000 to which all nations would be eligible to contribute. Contributions might be in gold, securities, or national currencies, and gold would comprise 30 to 50 percent of each nation's quota, based upon some accepted formula. The monetary unit would be the "unita," equal to 137⅐ grains of gold and having a value of $10 based on gold at $35 per fine ounce. The value of the "unita" could not be changed without the consent of 85 percent of the member countries.

Some objection was voiced to the American plan in that it was not clear what would happen if a contraction of world trade should set in after the war and certain nations should continue to have unfavorable trade balances year after year; or if a nation wanted to separate itself from world deflation to pursue independent policies of public works, expansion, and similar means of curing unemployment; or if a nation wanted to put into effect certain social reforms that might increase the cost of production of commodities. It was claimed that such factors would tend to unbalance trade or cause a fall in exchange, or both, and exchange rates could not be changed except by a majority or greater vote of the nations on the international monetary authority. Consequently, it was pointed out, the United States might be unable to fight a depression at home or might be obliged to accept a lower standard of living for its citizens than it would like to provide. The Canadian plan would give each country in the agreement the power unilaterally to depreciate its exchange once, up to 10 percent.

According to Condliffe,[1] there are three good reasons why gold should be used again in a restored international monetary standard: (1) Otherwise, the United States will have no use for its great accumulated stock; (2) British countries produce about three-fourths of current production, and the sale of their gold is an important item in settling the passive balance of the sterling area; (3) the U. S. S. R. is now one of the great gold-producing countries, and gold shipments are an important means of securing much-needed imports for the development of the country.

An unfavorable stand toward gold was taken by Hardy,[2] who states that "probably * * * gold will still be bought and sold to readjust the balance of payments, but the system could be run just as well without it."

A report from Russia indicates that the Soviet Government favors the use of gold after the war in international transactions and in the rehabilitation of its country. Unusual interest in gold was shown in other foreign countries. In India gold sold at $77.25 per ounce before the Government launched anti-inflationary measures and sold the metal officially to hoarders, which brought the price down eventually to $63 per ounce; in Egypt the Government was getting the equivalent of about $66 per ounce; in Argentina gold sold for $37 to $44 per ounce; and in Mexico, $38 to $39 per ounce. Early in 1944 the Chilean Government took steps to auction the gold contained in gold and copper ores, concentrates, and bars sent from Chile to the United States. These steps were taken to counter the rising inflation of Chile's paper currency and to halt the increasing flow of gold from Chile to the black markets of Argentina and Brazil.

In addition to much discussion on managed paper currency and gold in some form as an international monetary base, chaotic world conditions again brought up the age-old question of bimetallism and its place in post-war economic reconstruction. This standard, frequently condemned as unsound and unworkable, was championed, among others, by Brownell,[3] who took the position that the best interests of the United States and of the world at large demand that international bimetallism be adopted; and that past difficulties with the standard could be readily overcome if a universal fixed ratio were established between the two metals and if a fixed price were set for both the metals.

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[1] Condliffe, John B., Money and International Trade: Monetary Standards Inquiry, New York, 1944, p. 13.

[2] Hardy, Charles O., The Postwar Role of Gold: Monetary Standards Inquiry, New York, 1944, p. 26.

[3] Brownell, F. H., The United States Should Advocate International Bimetallism After the War: Extension of Remarks of Hon. Compton I. White, Congressional Record—appendix, April 16, 1943, pp. A 2005–A 2008.

Concerning the workability of bimetallism, White[4] wrote that a verdict of success or failure cannot be passed on bimetallism until it has been tried by all the leading nations at the same time with the same mint ratio in each country; and that the great obstacle to international bimetallism lies in the preference of mankind for gold money over silver money, with the result that in many transactions a premium for gold would be offered equal to the cost of handling and storing the two masses, and that the earliest sign of a premium on gold, after a bimetallic agreement had been made, would tend to render the agreement inoperative.

POST-WAR OUTLOOK

Gold will come out of World War II facing a rather unfavorable outlook. The industry should recover fairly rapidly following the removal of Government restrictions; but production is unlikely to return to the 1937–41 level for a number of years, unless the price of gold is increased. These conclusions are drawn from the following facts and inferences.

The production of gold bears a close, but not absolute, relation to the purchasing power of the gold ounce (the price of gold per fine ounce divided by the wholesale price index), so that gold output declines as the purchasing power of the gold ounce decreases and rises as the purchasing power increases. The truth of this is easily demonstrated. For example, in 1920 the purchasing power had slumped to 13, and gold output for the year was 2,383,000 ounces; in 1940 it had risen to 45, and production climbed to 4,870,000 ounces. It is generally believed that price controls will be maintained for some time after the war, and even if they were removed demand for consumer goods probably would hold prices at a high level for several years. Consequently, the gold industry is likely to be confronted with a much lower purchasing power than in the years of high production from 1937 to 1941. After post-war spending has subsided considerably, a period of falling prices may come, with a corresponding increase in the purchasing power of the gold ounce, and this will result in expanded gold mining. It is not improbable that this will happen.

Other probable factors that may retard recovery of the industry after the war are continued high labor costs and high taxes, the time and expense required to recondition many of the mines, and the time and expense of resuming development of ore.

On the whole, placer mining will recover its position more quickly than lode mining, as less time and expense will be required to recondition the workings and to develop ore. Also, wages in placer operations form a smaller part of the operating costs than in lode mining.

The future of gold as a monetary base cannot be predicted. Recent years have witnessed a drifting away from the various gold standards and the adoption by many economists of the theories of managed currencies. However, it is rather generally believed that gold in some form will be preserved as the principal monetary metal, so that gold mining should remain an important industry for years. If more gold is needed to support the monetary system adopted, it can be produced by raising the price of gold so that the purchasing power of the gold ounce will be increased.

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[4] White, Horace, Money and Banking: 6th ed., revised by Charles Tippets and Lewis A. Froman, Ginn & Co., 1935, pp. 90, 126.

Production of silver in the post-war period will be determined to a great extent by two factors: (1) Government policies to determine to what extent and at what price silver is used in the monetary system; (2) the price of copper, lead, and zinc.

Arguments are being advanced to show the advantages of international bimetallism and the greater use of silver in monetary systems in general. Only time will tell the outcome of these actions and their effects in increasing the price of silver to the benefit of the miner. In this respect, then, the silver industry is tightly interlocked with domestic and world political, economic, and monetary theories.

Silver will continue to be derived in considerable part as a byproduct in the mining of copper, lead, and zinc, and the output of the metal thus will be materially influenced by the prices of these base metals. It is generally believed that base-metal mining will continue at a reasonably high level after the war, hence silver from that source will appear in substantial quantities. Silver derived from dry and siliceous ores responds quickly to price changes, so that a sharp rise in price would result in a marked increase of metal from these ores. However, the tenor of silver ores in general has been declining for some years, so that in the future price increases must be greater than in the past if correspondingly greater quantities of silver are required.

The industrial use of silver has climbed phenomenally during the war, and some of these gains will be held in the post-war era. Also, it is certain that silver for subsidiary coinage will be required in greater quantities in rehabilitated countries. On the whole, the post-war outlook for silver is reasonably good, and for some years it is expected that domestic production will approximate that of the late 1920's.

DOMESTIC REFINERY PRODUCTION

The figures in the following table were obtained through cooperation between the United States Bureau of the Mint and the Bureau of Mines and were agreed upon after conference and adjustment between the two Bureaus.

The State totals are based upon bullion deposits in the United States mints and assay offices and upon returns to the Bureau of the Mint from smelting and refining companies. The state distribution is adjusted further by the Bureau of Mines from its geographical records of sources and production, both historical and current, from the producing mines and is tabulated for the mine reports discussed later. The data for the total production and in part for the distribution are obtained from records of (1) the unrefined domestic gold and silver deposited in the United States mints and assay offices; (2) the domestic gold and silver in fine bars reported by private refineries, supplemented by data of content of unrefined mattes, blister copper, copper anodes, and lead bullion; and (3) the unrefined domestic gold and silver contained in ore and matte exported for reduction. The last item is small.

Gold and silver produced in the United States, 1939–43, and approximate distribution of source, by States and Territories, in 1943

[Refinery figures supplied by U. S. Bureau of the Mint]

State or Territory	Gold[1]		Silver[2]	
	Fine ounces	Value	Fine ounces	Value
1939	5, 611, 171	$196, 391, 000	65, 119, 513	$44, 202, 279
1940	6, 003, 105	210, 108, 700	69, 585, 734	49, 483, 189
1941	5, 976, 419	209, 174, 600	72, 336, 029	51, 438, 954
1942	3, 741, 806	130, 963, 210	56, 090, 855	39, 886, 830
1943:				
Alaska	109, 707	3, 839, 745	45, 741	32, 527
Arizona	174, 164	6, 095, 740	5, 623, 678	3, 999, 060
California	148, 877	5, 210, 695	576, 826	410, 187
Colorado	134, 254	4, 698, 890	2, 670, 492	1, 899, 017
Georgia	10	350		
Idaho	29, 759	1, 041, 565	11, 420, 154	6, 120, 998
Illinois			395	281
Michigan			61, 726	43, 894
Missouri			39, 108	27, 810
Montana	61, 359	2, 147, 565	8, 164, 453	5, 805, 833
Nevada	140, 853	4, 929, 855	1, 824, 149	1, 297, 173
New Mexico	11, 161	390, 635	456, 485	324, 612
New York				
North Carolina	137	4, 795	7, 428	5, 282
Oregon	2, 406	84, 210	30, 990	22, 037
Pennsylvania	2, 222	77, 770	14, 507	10, 316
Philippine Islands	13, 764	481, 740	26, 071	18, 539
South Carolina	162	5, 670	139	99
South Dakota	113, 616	3, 976, 560	43, 745	31, 108
Tennessee	193	6, 755	47, 802	33, 993
Texas	131	4, 585	60, 109	42, 744
Utah	382, 445	13, 385, 575	9, 295, 245	6, 609, 952
Vermont	9	315	1, 449	1, 030
Virginia	24	840	9, 758	6, 939
Washington	69, 267	2, 424, 345	400, 189	284, 579
Wyoming	2	70		
	1, 394, 522	48, 808, 270	40, 820, 639	29, 028, 010

[1] Gold valued at $35 a fine ounce.

[2] Silver valued as follows: 1938, $0.646+; 1939, $0.678787+; 1940–43, $0.7111+.

Gold and silver produced in the United States, 1792–1943

[From Report of the Director of the Mint. The estimate for 1792-1873 is by R. W. Raymond, commissioner of mining statistics, and since then by the Director of the Mint]

Period	Gold		Silver	
	Fine ounces	Value[1]	Fine ounces	Value[2]
1792–1847	1, 187, 170	$24, 537, 000	309, 500	$404, 500
1848–72	58, 279, 778	1, 204, 750, 000	118, 568, 200	157, 749, 900
1873–1943	213, 094, 557	5, 030, 896, 770	3, 707, 343, 188	2, 784, 238, 688
	272, 561, 505	6, 260, 183, 770	3, 826, 220, 888	2, 942, 393, 088

[1] Gold valued in 1934 and thereafter at $35 per fine ounce; prior thereto at $20.67+ per fine ounce. Dollar figures are rounded.

[2] Silver valued in 1934 and thereafter at Government's average buying price for domestic product: In 1934 and 1938 at $0.64+ per fine ounce, in 1935 at $0.71875, in 1936 at $0.7745, in 1937 at $0.7735, in 1939 at $0.678787+, and in 1940–43 at $0.7111+.

PRICES OF GOLD AND SILVER

Since January 1934 the price of gold at the United States Mint has been $35 per fine troy ounce; the price of domestic silver mined after July 1, 1939, was fixed at $0.711+ per ounce on July 6, 1939. A complete account of regulations pertaining to gold and silver in 1933–34 is given in the chapter on Gold and Silver in Minerals Yearbook, 1934 (pp. 25–46).

According to the Director of the Mint, the following prices for silver prevailed in London and New York throughout 1943: London price per ounce, 0.925 fine, 23.5 d.; exchange, New York on London, $4.0350; United States equivalent, per fine ounce, of London price at current rate of exchange, $0.42713; New York price of fine bar silver, $0.45062.

UNITED STATES AND WORLD MONETARY STOCKS

The gold reserves of the United States continued to fall in 1943, according to the Federal Reserve Bulletin, and totaled $21,938,000,000 at the end of the year. This represents a decrease of $788,000,000 (over 3 percent) from the total of $22,726,000,000 at the close of 1942. The present holdings constitute about 67 percent of the total reserves of the world, believed to be about $33,000,000,000, including stabilization funds.

United States Treasury silver holdings at the close of 1943 approximated 3,254,000,000 ounces, a loss of about 80,000,000 ounces from 1942.

The Twenty-eighth Annual Review of the Silver Market, 1943, by Handy & Harman, contains the following comments on Treasury purchases, sales, and coinage of silver:

> For the first year since the inauguration of the silver purchase program in 1934, United States Government holdings of the white metal showed a decrease. No foreign silver at all was bought during 1943 and acquisitions of newly-mined domestic silver amounted to only 5,400,000 ounces. In addition, a scant 400,000 ounces were received in miscellaneous deposits at the mints and assay offices. On the other hand, substantial quantities of bullion were released from Treasury stocks for various purposes. Nearly 4,000,000 ounces of "silver ordinary" were sold to industry, this amount being the balance remaining from the Treasury Department's original offer made in September 1942. During the first eleven months of the year 21,500,000 ounces were consumed in the coinage of new nickels. The silver used in these coins constituted a loss to Treasury stocks because nickels are classed as "minor coinage" and their silver content is not included in such stocks. Official figures for the same eleven months disclose the fact that 17,218,000 ounces were sold to industry under the Green Act and that 40,897,000 ounces were lend-leased. We understand that the latter amount was the result of direct transactions between the United States and other governments, and that the silver was shipped abroad mostly as bullion, although 5,823,000 ounces were in the form of coinage. While no confirmation is available, it seems likely that Great Britain and India were the principal beneficiaries of this lend-leased silver.
>
> The foregoing figures show a net decrease in Treasury silver holdings of 77,800,000 ounces, but inasmuch as sales under the Green Act continued during December and lend-lease transfers may well have continued, the net decrease for the year 1943 should exceed 80,000,000 ounces. In spite of this decrease, progress was made towards the goal set by the Silver Purchase Act that "one-fourth of the total monetary value of the gold and silver stocks shall be in silver". This fact, paradoxical as it may seem, was accomplished because of the decrease in Treasury gold holdings.
>
> According to the Treasury's Daily Statement dated December 31st, 1943, there were 1,175,000,000 ounces of Government-owned silver bullion which remained unpledged as backing for silver certificates. However, a footnote indicates that of this silver the Defense Plant Corporation, etc. held 829,000,000 ounces, an amount which was 242,000,000 ounces larger than that held at the end of 1942.
>
> In 1943 the United States used more silver for domestic coinage than in any prior year. Official figures for the first eleven months show that 95,818,000 ounces were so consumed, this amount being 17,000,000 ounces more than the former full year's record established in 1942. As previously mentioned, 21,500,000 ounces went into the new "silver" nickels, which left a balance of 74,300,000 ounces for subsidiary coinage consisting of half-dollars, quarters, and dimes. Up to June 30th 6,000,000 ounces of silver for subsidiary coinage

were obtained from the melting of "worn and uncurrent" standard silver dollars, and it is probable that many more millions of ounces were derived from the same source during the next five months, because in that period the number of standard silver dollars decreased by 34,717,000 coins, which would produce almost 27,000,000 ounces.

CONSUMPTION AND USES

Gold.—Gold continued to play an important part in the war for use in many types of instruments, electrical and industrial equipment, and color photography. No figures are available on the quantity of gold used in the various products.

Silver.—The gross industrial consumption of silver rose from an estimated 121,000,000 ounces in 1942 to 159,000,000 ounces in 1943, distributed by uses as follows: [5]

	1942	*1943*
Bearings	10, 000, 000	25, 000, 000
Photographic	20, 000, 000	20, 000, 000
Brazing alloys	(1)	20, 000, 000
Contacts	10, 000, 000	10, 000, 000
Dental and surgical	2, 000, 000	5, 000, 000
Insignia	5, 000, 000	5, 000, 000
Solder	1, 000, 000	4, 000, 000
Chemical products, n. e. s	3, 000, 000	3, 000, 000
Silverware	30, 000, 000	30, 000, 000
Jewelry	10, 000, 000	5, 000, 000
Unclassified	30, 000, 000	32, 000, 000
Total	121, 000, 000	159, 000, 000

[1] Included under "Unclassified."

It is estimated that about 65 percent of the silver consumed in the United States in 1943 went into war production or for purposes classified as essential by the War Production Board. Important gains were registered in the use of silver in silver-lead solders to conserve tin in the lead-tin soft solders; in brazing alloys for joining parts of ships, planes, tanks, guns, bombs, shells, rockets and torpedoes, field kitchens, and many other items; and in highly important dental and medical work. Military photography continued to absorb large quantities of silver, as did silverware for the armed forces.

Two new interesting applications of silver have been announced recently. The first, discovered by the Sunshine Mining Co. and developed by the Rare Metals Institute, is a method of converting sea water into palatable drinking water through use of silver chemicals. The second, developed by E. I. du Pont de Nemours and Co., uses silver powder in a new ceramic-type composition as a coating on electrically nonconducting materials, such as glass and wood, to give the surface high electrical conductivity and low electrical resistance.

The following table shows the net industrial consumption of gold and silver in the United States for the 5-year period 1939–43, inclusive, in terms of dollars for gold and fine ounces for silver. The quantity of each metal reclaimed and recovered from various sources is deducted from that issued for industrial use to give the net amount.

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[5] Engineering and Mining Journal, vol. 145, February 1944, pp. 72–74.

Net industrial consumption of gold and silver in the United States, 1939–43 [1]

Year	Gold (dollars)			Silver (fine ounces)		
	Returned from industrial use	Issued for industrial use	Net industrial consumption	Returned from industrial use	Issued for industrial use	Net industrial consumption
1939	31,328,360	38,788,960	7,460,600	24,972,260	69,585,265	44,613,005
1940	27,872,355	41,178,387	13,306,032	22,563,729	67,062,632	44,498,903
1941	30,975,490	67,977,110	37,001,620	20,361,256	92,793,574	72,432,318
1942	28,447,685	75,742,495	47,294,810	30,020,529	131,419,224	101,398,695
1943	10,521,000	96,864,353	86,343,353	32,172,177	162,112,863	129,940,686

[1] U. S. Bureau of the Mint.

IMPORTS AND EXPORTS [6]

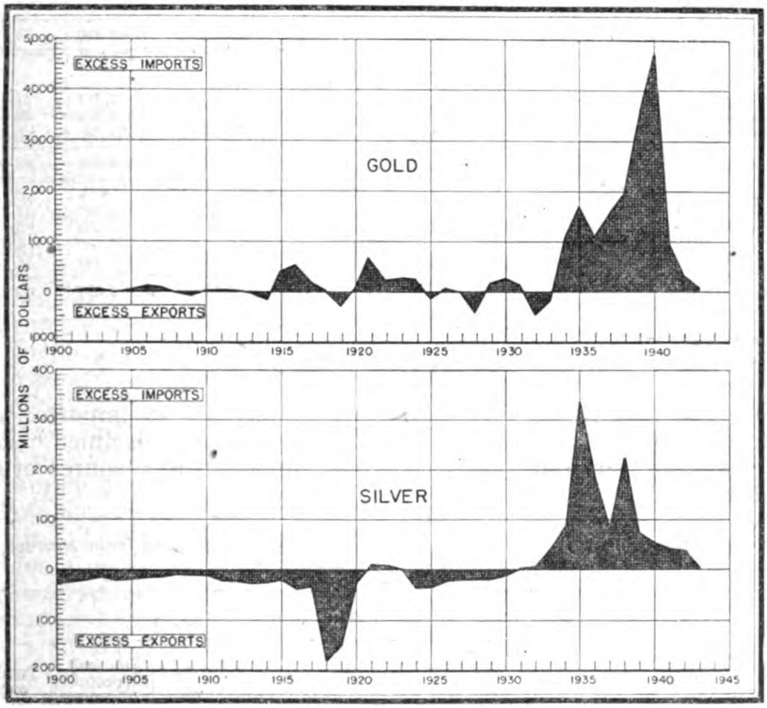

FIGURE 1.—Gold and silver imports and exports, with net movements, 1900–43.

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[6] Figures compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Value of gold and silver imported into and exported from the United States, 1942–43, by classes

	Imports	Exports	Excess of imports over exports
1942			
Gold:			
Contained in ore and base bullion	$47, 413, 550	$22, 685	$47, 390, 865
Bullion refined	268, 005, 947	79, 441	267, 926, 506
United States coin	290		290
Foreign coin	359, 929		359, 929
	315, 779, 716	102, 126	315, 677, 590
Silver:			
Contained in ore and base bullion	12, 711, 949	1, 635	12, 710, 314
Bullion refined	28, 002, 573	504, 105	27, 498, 468
United States coin	163, 085	26, 000	137, 085
Foreign coin	225, 542	1, 467, 750	[1] 1, 242, 208
	41, 103, 149	1, 999, 490	39, 103, 659
1943			
Gold:			
Contained in ore and base bullion	41, 476, 425	2, 161	41, 474, 264
Bullion refined	60, 257, 519	24, 110, 100	36, 147, 419
Foreign coin	58, 801	8, 742, 329	[1] 8, 683, 528
	101, 792, 745	32, 854, 590	68, 938, 155
Silver:			
Contained in ore and base bullion	17, 667, 905	188, 381	17, 479, 524
Bullion refined	9, 933, 867	15, 451, 062	[1] 5, 517, 195
United States coin	290, 741	1, 328, 650	[1] 1, 037, 909
Foreign coin	10, 447	13, 721, 304	[1] 13, 710, 857
	27, 902, 960	30, 689, 397	[1] 2, 786, 437

[1] Excess of exports.

DOMESTIC SUPPLY

In 1943 base-metal ores continued to increase in importance as sources of gold and silver, and dry and siliceous ores declined. Likewise, placers were relatively much less important as a source of gold than in 1942.

Mine production of gold in the United States, 1939–43, by percent from sources, and in total fine ounces [1]

Year	Percent from—						Total fine ounces
	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1939	28.6	59.8	10.1	0.3	(2)	1.3	4, 673, 042
1940	31.0	55.6	11.0	.4	(2)	2.0	4, 869, 949
1941	31.3	54.3	11.8	.5	(2)	2.0	4, 750, 865
1942	29.3	50.0	17.0	.7	(2)	2.9	3, 457, 110
1943	11.6	38.3	39.5	1.1	0.3	9.2	1, 363, 815

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.1 percent.

Mine production of silver in the United States, 1939–43, by percent from sources, and in total fine ounces[1]

Year	Percent from—						Total fine ounces
	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1939	0.3	47.0	28.6	4.6	0.1	19.4	64,373,281
1940	.3	41.3	29.3	4.5	(2)	24.6	70,549,362
1941	.3	41.2	27.9	5.6	.3	24.7	67,258,997
1942	.3	37.3	27.8	5.5	1.2	28.0	54,090,765
1943	(2)	26.1	33.7	8.1	1.2	31.0	41,460,826

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.1 percent.

MINE REPORT

METHOD OF COLLECTING STATISTICS

The second table in this report presents the official refinery figures for production of gold and silver in the United States from 1937 to 1941, as agreed upon by the Bureau of the Mint and the Bureau of Mines. These figures record the output of gold and silver bullion from domestic ore in marketable form as metals, either refined or unrefined.

To trace the gold and silver produced back to its source by States, counties, and mining districts, the Bureau of Mines systematically investigates the "mine production" of ores containing gold and silver and the output of the placer mines, the total being classified by methods of production and by kinds of ore, as well as by mining districts. The resulting figures form the basis of the mine reports.

Of the two systems for ascertaining the production of gold and silver, one is a measure of the metallurgic industry and the other of the mining industry; one reports the metal actually recovered in marketable form and the other the mine output and its recoverable content. The two methods will not produce identical results, but data for a period of years long enough to compensate for overlap or lag should agree within allowable limits of error.

Compared with the mine reports, the mint reports for the 39 years show a total excess of gold of 314,317 ounces (a difference of 0.22 percent) and a total excess of silver of 12,182,219 ounces (a difference of 0.54 percent).

Gold and silver produced in the United States, 1905–43, in fine ounces, according to mint and mine returns, in terms of recovered metals

Year	Mint		Mine	
	Gold	Silver	Gold	Silver
1905–38	119,314,545,	1,960,694,118	119,195,390	1,950,782,707
1939	5,611,171	65,119,513	5,672,485	65,565,024
1940	6,003,105	69,585,734	5,984,163	71,824,746
1941	5,976,419	72,336,029	5,881,798	68,483,333
1942	3,741,806	56,090,855	3,615,836	54,321,962
1943	1,394,522	40,820,639	1,377,579	41,486,897
	142,041,568	2,264,646,888	141,727,251	2,252,464,669

UNITS OF MEASUREMENT

All tonnage figures are short tons of 2,000 pounds "dry weight"; that is, they do not include moisture. The weight unit for gold and silver is the troy ounce (480 grains). The totals are calculated upon the basis of recovered and recoverable fine gold and silver shown by assays to be contained in ore, bullion, and other material produced. Prices of gold and silver are discussed in a preceding section of this report.

MINES PRODUCING

LEADING GOLD MINES

The 15 leading gold producers (each produced more than 17,000 ounces) listed below had an output of 956,676 ounces in 1943 or 70 percent of the United States total (Philippine Islands and Puerto Rico excluded). The output of lode mines and placers producing less than 17,000 ounces each was 407,139 ounces, or 30 percent of the total.

Largest producers of gold in the United States in 1943, in order of output [1]

Rank	Operator	State	Mining district	Source of gold
1	Utah Copper Co	Utah	West Mountain	Copper ore.
2	Homestake Mining Co	South Dakota	Whitewood	Dry and siliceous gold ore.
3	Phelps Dodge Corporation	Arizona	Ajo, Copper Mountain, Verde, Warren.	Copper ore.
4	Golden Cycle Corporation [2]	Colorado	Cripple Creek, etc	Dry and siliceous gold ore.
5	Howe Sound Co	Washington	Chelan Lake	Copper ore.
6	Alaska Juneau Gold Mining Co.	Alaska	Juneau	Dry and siliceous gold ore.
7	Yuba Consolidated Gold Fields.	California	Callahan, Orville, Yuba River.	Dredging gravel.
8	Kennecott Copper Corporation.	Nevada	Robinson	Copper ore.
9	Getchell Mines, Inc	do	Potosi	Dry and siliceous gold ore.
10	Consolidated Copper Mines Corporation.	do	Robinson	Copper ore.
11	United States Smelting, Refining and Mining Co.	Utah	West Mountain	Zinc-lead ore, lead ore, dry and siliceous gold-silver ore.
12	Knob Hill Mines, Inc	Washington	Republic	Dry and siliceous gold ore.
13	Telluride Mines, Inc	Colorado	Upper San Miguel	Dry and siliceous gold-silver ore.
14	Shenandoah-Dives Mining Co.[3]	do	Animas	Do.
15	New Park Mining Co	Utah	Park City	Zinc-lead ore.

[1] Philippine Islands excluded.

[2] Custom mill. Includes mainly ore from Portland, Ajax, Vindicator, and other mines in Cripple Creek district, Colorado, but also from other districts in Colorado.

[3] Custom mill. Includes ore treated from Eureka and Ice Lake districts, Colorado.

LEADING SILVER PRODUCERS

The output of the 34 leading silver producers (each produced more than 180,000 ounces) listed below was 32,023,947 ounces—77 percent of the total mine output of the United States (Philippine Islands and Puerto Rico excluded). The remaining mines produced 9,436,879 ounces, or 23 percent of the total.

Largest producers of silver in the United States in 1942, in order of output

Rank	Operator	State	Mining district	Source of silver
1	Anaconda Copper Mining Co.	Montana	Summit Valley or Butte.	Copper ore, zinc-lead ore, dry and siliceous silver ore.
2	Sunshine Mining Co	Idaho	Evolution	Dry and siliceous silver ore.
3	Phelps Dodge Corporation	Arizona	Ajo, Copper Mountain, Verde, Warren.	Copper ore, dry and siliceous gold and silver ores.
4	Utah Copper Co	Utah	West Mountain	Copper ore.
5	United States Smelting, Refining & Concentrating Co.	do	Ophir and West Mountain.	Zinc-lead-copper ore, zinc-lead ore.
6	Bunker Hill & Sullivan Mining & Concentrating Co.	Idaho	Yreka	Zinc-lead ore, lead ore, dry and siliceous silver ore.
7	Federal Mining & Smelting Co.	do	Hunter and Yreka	Zinc-lead ore.
8	Polaris Mining Co	do	Evolution	Dry and siliceous silver ore.
9	Coeur d'Alene Mines Corporation.	do	do	Do
10	Silver King Coalition Co	Utah	Uintah	Zinc-lead ore, lead ore.
11	Triumph Mining Co	Idaho	Warm Springs	Zinc-lead ores.
12	Tintic Standard Mining Co	Utah	Tintic	Lead ore, dry and siliceous gold-silver ore, dry and siliceous silver ore.
13	New Park Mining Co	do	Park City	Zinc-lead ore.
14	Emperius Mining Co.[1]	Colorado	Creede	Dry and siliceous silver ore.
15	Hecla Mining Co	Idaho	Lelande	Zinc-lead ore, lead ore.
16	Anaconda Copper Mining Co. (Flathead and West Flathead mines).	Montana	Hog Heaven	Lead ore, dry and siliceous silver ore.
17	Magma Copper Co	Arizona	Pioneer	Copper ore- zinc ore.
18	Park Utah Consolidated Mines Co.	Utah	Park City	Zinc-lead ore, lead ore.
19	Combined Metals Reduction Co. (West Calumet and Butterfield mines).	do	Rush Valley and West Mountain.	Zinc-lead ore, dry and siliceous gold ore.
20	Shattuck Denn Mining Corporation (Iron King and Denn mines).	Arizona	Big Bug and Warren	Copper ore, zinc-lead ore, dry and siliceous gold-silver ore.
21	Sherman Lead Co	Idaho	Lelande	Lead ore.
22	Midnight Mining Co	Colorado	Roaring Fork	Dry and siliceous silver ore.
23	Anaconda Copper Mining Co. (Emma and Ophir).	Montana	Summit Valley or Butte.	Zinc-lead ore.
24	Sullivan Mining Co	Idaho	Hunter	Do.
25	Philipsburg Mining Co	Montana	Flint Creek	Dry and siliceous gold ore, dry and siliceous silver ore.
26	Combined Metals Reduction Co.	Nevada	Pioche	Zinc-lead ore.
27	St. Joseph Lead Co	Montana	Barker	Do.
28	Desert Silver, Inc	Nevada	Silver Peak	Dry and siliceous silver ore.
29	American Smelting and Refining Co.	Utah	Tintic	Dry and siliceous ore.
30	Chief Consolidated Mining Co.	do	do	Zinc-lead ore, lead ore, dry and siliceous gold-silver ore.
31	American Smelting and Refining Co. (Trench and Flux Unit).	Arizona	Harshaw	Zinc-lead ore.
32	Kennecott Copper Corporation.	Nevada	Robinson	Copper ore.
33	Mike Horse Mining and Milling Co.	Montana	Heddleston	Zinc-lead ore.
34	Clayton Silver Mines	Idaho	Bayhorse	Do.

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[1] Comprises output from all the Creede district including custom ore from sublesses.

NUMBER OF MINES

The following table indicates the number of mines that produced gold and silver in 1942 and 1943. The placers are those in which gold and silver in natural alloy and, in a few placers, platinum are recovered from gravel and sand, whether by hand washing, sluicing, hydraulicking, drifting (in frozen ground or ancient buried river channels), or dredging. The lode mines are those yielding gold and silver from ore as distinguished from gravel, mainly from underground workings, and include those that yield ore mined chiefly for copper, lead, or zinc but that contribute the precious metals as byproducts.

The enumeration of placer mines is less satisfactory than that of lode mines, because some are operated only temporarily and are individually small. As far as possible the unit, as for lode mines, is not the operator but the mining claim or group of claims.

Number of mines in the United States producing gold or silver, 1942–43, by States

State	Lode		Placer		Total	
	1942	1943	1942	1943	1942	1943
Alabama	1	----------	----------	----------	1	----------
Alaska	38	8	453	114	491	122
Arizona	503	260	163	19	666	279
California	434	139	428	82	862	221
Colorado	311	236	68	17	379	253
Georgia	3	----------	15	3	18	3
Idaho	201	127	236	30	437	157
Illinois	2	2	----------	----------	2	2
Michigan	2	2	----------	----------	2	2
Missouri	3	3	----------	----------	3	3
Montana	369	223	170	45	539	268
Nevada	434	168	49	17	483	185
New Mexico	78	59	48	16	126	75
New York	1	1	----------	----------	1	1
North Carolina	7	3	1	----------	8	3
Oregon	48	16	83	16	131	32
Pennsylvania	1	1	----------	----------	1	1
South Carolina	4	1	----------	----------	4	1
South Dakota	5	3	13	----------	18	3
Tennessee	3	1	----------	----------	3	1
Texas	7	8	----------	----------	7	8
Utah	119	107	6	1	125	108
Vermont	----------	1	----------	----------	----------	1
Virginia	2	1	1	----------	3	1
Washington	37	24	18	2	55	26
Wyoming	6	----------	6	----------	12	----------
	2,619	1,394	1,758	362	4,377	1,756

MINE PRODUCTION

The following table gives the mine production of gold and silver in 1942 and 1943, by States, in terms of recovered metals, as calculated by the Bureau of Mines from reports from the producing mines.

Mine production of gold and silver in the United States, 1942–43, by regions and States, in terms of recovered metals [1]

Region and State	Gold					Silver				
	Fine ounces		Increase or decrease (percent)	Value (at $35 per ounce)		Fine ounces		Increase or decrease (percent)	Value (at $0.71111+ per ounce)	
	1942	1943		1942	1943	1942	1943		1942	1943
Western States and Alaska:										
Alaska	487, 621	99, 583	−80	$17, 066, 735	$3, 485, 405	119, 704	42, 788	−64	$85, 123	$30, 427
Arizona	253, 651	171, 810	−32	8, 877, 785	6, 013, 350	7, 064, 467	5, 713, 889	−19	5, 023, 621	4, 063, 210
California	847, 997	148, 328	−83	29, 679, 895	5, 191, 480	1, 450, 440	609, 075	−58	1, 031, 424	433, 120
Colorado	268, 627	137, 558	−49	9, 401, 945	4, 814, 530	3, 096, 211	2, 664, 142	−14	2, 201, 750	1, 894, 501
Idaho	95, 020	30, 808	−68	3, 325, 700	1, 078, 280	14, 644, 890	11, 700, 180	−20	10, 414, 144	8, 320, 128
Montana	146, 892	59, 586	−59	5, 141, 220	2, 085, 510	11, 188, 118	8, 450, 370	−24	7, 955, 995	6, 009, 152
Nevada	295, 112	144, 442	−51	10, 328, 920	5, 055, 470	3, 723, 435	1, 620, 280	−56	2, 647, 776	1, 152, 199
New Mexico	11, 961	5, 563	−53	418, 635	194, 705	676, 170	463, 583	−31	480, 832	329, 659
Oregon	46, 233	1, 097	−98	1, 618, 155	38, 395	87, 376	10, 523	−88	62, 134	7, 483
South Dakota	522, 098	106, 444	−80	18, 273, 430	3, 725, 540	186, 937	35, 886	−81	132, 933	25, 519
Texas	236	4	−98	8, 260	140	672, 781	10, 284	−98	478, 422	7, 313
Utah	391, 544	390, 470	(2)	13, 704, 040	13, 666, 450	10, 574, 955	9, 479, 340	−10	7, 519, 968	6, 740, 864
Washington	75, 396	65, 244	−13	2, 638, 860	2, 283, 540	369, 038	370, 440	(2)	262, 427	263, 424
Wyoming	23		−100	805		52		−100	37	
	3, 442, 411	1, 360, 937	−60	120, 484, 385	47, 632, 795	53, 854, 574	41, 170, 780	−24	38, 296, 586	29, 276, 999
Eastern States:										
Alabama	1		−100	35						
Georgia	30	12	−60	1, 050	420	7		−100	5	
New York						40, 012	38, 004	−5	28, 453	27, 025
North Carolina	4, 077	131	−97	142, 695	4, 585	8, 259	7, 169	−13	5, 873	5, 098
Pennsylvania	2, 499	2, 218	−11	87, 465	77, 630	15, 501	13, 095	−16	11, 023	9, 312
South Carolina	7, 824	147	−98	273, 840	5, 145	5, 064	135	−97	3, 601	96
Tennessee	159	303	+91	5, 565	10, 605	34, 671	52, 058	+50	24, 655	37, 019
Vermont		17			595		2, 721			1, 935
Virginia	109	50	−54	3, 815	1, 750	1, 793	14, 947	+734	1, 275	10, 629
	14, 699	2, 878	−80	514, 465	100, 730	105, 307	128, 129	+22	74, 885	91, 114
Central States:										
Illinois						104	2, 153	+2, 049	74	1, 531
Michigan						61, 674	48, 479	−21	43, 857	34, 474
Missouri						69, 106	111, 285	+61	49, 142	79, 136
						130, 884	161, 917	+24	93, 073	115, 141
	3, 457, 110	1, 363, 815	−61	120, 998. 850	47, 733. 525	54, 090, 765	41, 460. 826	−23	38, 464, 544	29, 483, 254

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[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.5 percent.

ORE PRODUCTION, CLASSIFICATION, METAL YIELD, AND METHODS OF RECOVERY

The best index of lode mining is the quantity and metallic content of ore mined rather than the number of mines or operators. The following tables give details of classes of ore, metal yield in fine ounces of gold and silver to the ton, and gold and silver output by classes of ore and by methods of recovery, embracing all ores that yielded gold and silver in the United States (excluding the Philippine Islands and Puerto Rico) in 1943. The individual State chapters from which these tables were compiled contain additional tables and text on the subject and may be found elsewhere in this volume.

The classification originally adopted in 1905 on the basis of smelter terminology, smelter settlement contracts, and smelter recovery has been used continuously in succeeding years, except for modifications necessitated by the improvement in recovery of metals and the lowering of grade of complex ores treated, accomplished by improved mill concentration processes. A "dry" ore is one that carries so little lead or copper that by itself in quantity it would not satisfy the requirements for the smelter charge in lead smelting or copper smelting, respectively. The copper ores include those smelting ores that contain 2.5 percent dry assay or more of copper (or less than this percentage if no other metal is present), or those ores concentrated chiefly for their copper content. The lead ores are those that contain 5 percent dry assay (minimum lead smelting charge requires 7.5 to 8.5 percent wet assay) or more of lead, irrespective of precious-metal content; an ore that carries any grade of lead exclusively is called a lead ore. Zinc smelting ores (chiefly oxides) range from 16 to 45 percent zinc; zinc concentrating ores include any grade of zinc ore that makes marketable zinc concentrate, irrespective of precious-metal content. The mixed ores are combinations of those enumerated. The smelter classification applies to concentrates.

Siliceous (silica [7] in excess of iron) gold, gold-silver, and silver ores containing too little copper, lead, or zinc to be classified as copper, lead, zinc, or mixed ores are called "dry" ores regardless of the ratio of concentration, except low-grade ore milled chiefly for its copper content and having very little or no precious-metal content (chiefly the "porphyry coppers") and ores from which separate products of lead concentrates and zinc concentrates are made. The crude ore into the mill in these two exceptional instances thus takes its name from its products—a name that is also justified by the mineralogical content and final recovery of metals. The "dry and siliceous ores" thus, by elimination, include both dry siliceous and irony, but chiefly siliceous, ores valuable for their gold and silver content, regardless of method of treatment, and dry fluxing ores carrying considerable quantities of iron and manganese oxides, or iron sulfide, and very small quantities of gold and silver. Dry and siliceous gold ores are those that by inspection are overwhelmingly of gold content; a similar qualification applies to silver ores; decision as to "gold-silver" ore is made arbitrarily on a basis of value, using the rule that the metal of lower value is not used in the bimetal classification unless its value is equal to or over one-quarter of the combined value of the gold and silver.

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[7] Except where mineralization approaches a matte, ores in their natural state generally contain more silica than iron and usually are highly siliceous

The lead, zinc, and zinc-lead ores in most districts in the Eastern and Central States carry no appreciable quantity of gold or silver; such ores are excluded from this report unless otherwise indicated.

Ore produced in the United States and average recovery in fine ounces of gold and silver per ton in 1943 [1]

State	Gold ore			Gold-silver ore			Silver ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States:									
Arizona	138, 144	0. 167	0. 35	23, 662	0. 089	3. 85	24, 379	0. 032	10. 11
California	409, 512	. 122	. 32	2, 850	. 133	3. 99	431	------	4. 39
Colorado	885, 838	. 129	. 61	30, 105	. 105	3. 74	78, 883	. 008	12. 37
Idaho	65, 352	. 250	. 89	178, 749	. 031	. 97	287, 344	. 001	16. 00
Montana	72, 616	. 293	. 36	53, 890	. 072	4. 96	140, 466	. 016	7. 17
Nevada	377, 022	. 135	. 14	51, 293	. 112	5. 76	33, 860	. 030	9. 84
New Mexico	200	4. 410	1. 13	904	. 792	52. 41	1, 812	. 019	7. 73
Oregon	2, 646	. 334	3. 97	------	------	------	------	------	------
South Dakota	202, 018	. 527	. 16	------	------	------	------	------	------
Texas	39	. 103	1. 10	------	------	------	3, 601	------	2. 77
Utah	68, 085	. 250	1. 18	212, 039	. 064	3. 33	72, 351	. 026	9. 91
Washington	61, 002	. 376	2. 84	74	. 027	1. 97	144	. 007	5. 23
Wyoming	------	------	------	------	------	------	------	------	------
	2, 282, 474	. 185	. 51	553, 566	. 063	3. 08	643, 271	. 010	21. 39
Alaska	1, 483, 519	. 039	. 03	------	------	------	------	------	------
Eastern States	156	. 942	. 87	------	------	------	------	------	------
	3, 766, 149	. 128	. 32	553, 566	. 063	3. 08	643, 271	. 010	21. 39

State	Copper ore			Lead ore			Lead-copper ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States:									
Arizona	36, 022, 080	0. 004	0. 12	41, 006	0. 028	1. 85	182	0. 005	13. 15
California	265, 526	. 011	. 18	49, 038	. 070	6. 05	------	------	------
Colorado	3, 008	. 025	4. 02	15, 291	. 140	8. 00	65	. 123	10. 62
Idaho	329	. 073	25. 88	237, 122	. 001	7. 67	68	. 015	120. 18
Montana	5, 068, 865	. 003	1. 19	8, 449	. 125	9. 69	------	------	------
Nevada	7, 721, 562	. 009	. 05	22, 297	. 047	13. 17	------	------	------
New Mexico	7, 571, 937	(2)	. 01	586	. 200	8. 62	60	------	2. 90
Oregon	34	. 118	. 09	------	------	------	------	------	------
South Dakota	------	------	------	------	------	------	------	------	------
Texas	339	------	. 29	155	------	1. 00	------	------	------
Utah	35, 999, 656	. 009	. 08	48, 658	. 115	10. 95	53	. 019	14. 49
Washington	2, 339	. 005	. 48	374	------	4. 97	------	------	------
Wyoming	------	------	------	------	------	------	------	------	------
	92, 655, 675	. 006	. 15	422, 976	. 035	7. 90	428	. 026	28. 50
Alaska	8	2. 375	6. 50	------	------	------	------	------	------
Eastern States	1, 060, 458	(2)	. 06	2, 666	------	------	------	------	------
	93, 716, 141	. 006	. 15	425, 642	. 035	7. 90	428	. 026	28. 50

See footnotes at end of table.

Ore produced in the United States and average recovery in fine ounces of gold and silver per ton in 1943 [1]—Continued

State	Zinc ore			Zinc-lead, zinc-copper, and zinc-lead-copper ores [3]			Total ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States:									
Arizona	3,083	0.004	3.76	378,252	0.028	2.30	36,630,788	0.005	0.156
California	8,428	.053	1.96	4,171	.046	23.82	739,956	.080	.82
Colorado	4,378	.016	1.66	613,750	.028	1.45	1,631,318	.084	1.63
Idaho	[4] 44,382	.001	1.05	1,928,401	.004	2.59	[4] 2,741,747	.011	4.27
Montana	[5] 234,361	(2)	.19	294,369	.009	3.43	[5] 5,873,016	.008	1.44
Nevada	156,845	.012	1.69	1,164	.016	.19	8,364,043	.016	.19
New Mexico	361,391	.003	.18	392,153	.002	.59	8,329,043	.001	.06
Oregon							2,680	.332	3.92
South Dakota				2,914	.019	1.10	204,932	.519	.18
Texas							4,134	.001	2.49
Utah	[6] 231,845	(2)	.08	754,044	.056	5.98	[6] 37,386,731	.010	.25
Washington	19,412	.014	.47	1,047,936	.040	.18	1,131,281	.058	.33
Wyoming									
	1,064,125	(2)	.46	5,417,154	.023	2.36	103,039,669	.011	.40
Alaska							1,483,527	.039	.03
Eastern States	2,243,047			905,634	(2)	.06	[7] 4,211,961	.001	.03
	3,307,172	(2)	.15	6,322,788	.020	2.03	108,735,157	.011	.38

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.

[2] Less than 0.0005 ounce per ton.

[3] Includes zinc-copper ore from Arizona, California, and Washington and zinc-lead-copper ore from Arizona and Utah.

[4] Includes 39,465 tons of zinc slag from which no gold and silver were recovered.

[5] Includes 225,261 tons of zinc slag which contained some silver but no gold.

[6] Includes 109,042 tons of zinc slag from which gold and silver were recovered.

[7] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Gold and silver produced in the Western States of the United States, 1848–1943, and in Alaska, 1880–1943, in terms of recovered metals

[Original research, 1848-1903, by Chas. W. Henderson; 1904-43, Economics and Statistics Service]

State	Period	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
Alaska	1880–1943	25,739,234	$613,887,792	19,725,160	$14,031,221
Arizona	1860–1943	10,599,750	258,486,405	281,466,394	208,968,600
California	1848–1943	101,259,084	2,246,171,592	105,091,703	84,800,447
Colorado	1858–1943	38,702,940	848,479,864	723,710,917	562,577,427
Idaho	1863–1943	7,754,986	174,563,913	495,920,027	340,934,359
Montana	1862–1943	16,886,996	375,498,072	732,841,398	535,161,819
Nevada	1859–1943	25,215,000	561,086,676	586,050,045	538,078,376
New Mexico	1848–1943	2,166,304	49,154,833	66,416,329	51,960,697
Oregon	1852–1943	5,668,118	126,347,173	5,187,681	4,767,004
South Dakota	1876–1943	20,666,185	504,924,184	9,569,099	6,807,080
Texas	1885–1943	8,281	223,780	33,196,821	23,360,028
Utah	1864–1943	9,840,243	244,633,545	701,354,446	511,016,100
Washington	1860–1943	2,022,365	49,538,098	11,962,368	8,466,998
Wyoming	1867–1943	77,914	1,835,318	74,632	51,752
Total, Western States and Alaska	1848–1943	266,607,700	6,054,831,245	3,772,567,020	2,890,981,908

Mine production of gold in the United States in 1943, by States and sources, in fine ounces, in terms of recovered metals [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alaska	42,111	57,453	19					99,583
Arizona	319	25,884	133,746	1,131	1	11	10,718	171,810
California	89,425	50,140	2,971	3,411		450	1,931	148,328
Colorado	521	117,713	76	2,141	8	68	17,031	137,558
Georgia	12							12
Idaho	255	21,974	24	333	1	58	8,163	30,808
Montana	14,072	27,384	14,355	1,056		58	2,661	59,586
Nevada	11,229	57,734	72,449	1,053		1,904	73	144,442
New Mexico	92	1,633	2,058	117		934	729	5,563
North Carolina			131					131
Oregon	208	885	4					1,097
Pennsylvania			[2] 2,218					2,218
South Carolina		147						147
South Dakota		106,389					55	106,444
Tennessee			303					303
Texas		4						4
Utah	4	32,393	310,242	5,609	1	34	42,187	390,470
Vermont			17					17
Virginia							50	50
Washington	116	22,930	11			263	41,924	65,244
	158,364	522,663	538,624	14,851	11	3,780	125,522	1,363,815

[1] Philippine Islands and Puerto Rico excluded.
[2] From magnetite-pyrite-chalcopyrite ore.

Mine production of silver in the United States in 1943, by States and sources, in fine ounces, in terms of recovered metals [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alaska	5,102	37,634	52					42,788
Arizona	14	386,209	4,367,003	76,019	2,393	11,588	870,663	5,713,889
California	5,992	143,126	47,214	296,829		16,546	99,368	609,075
Colorado	90	1,628,673	12,107	122,305	690	7,272	893,005	2,664,142
Georgia								
Idaho	69	4,828,391	8,515	1,819,699	8,172	46,806	4,988,528	11,700,180
Illinois							2,153	2,153
Michigan			48,479					48,479
Missouri				111,285				111,285
Montana	1,350	1,300,100	6,012,808	81,881		45,375	1,008,856	8,450,370
Nevada	4,434	681,710	365,112	293,724		264,860	10,440	1,620,280
New Mexico	25	61,619	100,503	5,054	174	64,154	232,054	463,583
New York							38,004	38,004
North Carolina			7,169					7,169
Oregon	28	10,492	3					10,523
Pennsylvania			[2] 13,095					13,095
South Carolina		135						135
South Dakota		32,688					3,198	35,886
Tennessee			52,058					52,058
Texas		10,031	98	155				10,284
Utah		1,502,701	2,917,239	532,911	768	19,502	4,506,219	9,479,340
Vermont			2,721					2,721
Virginia							14,947	14,947
Washington	17	174,014	1,119	1,859		9,150	184,281	370,440
	17,121	10,797,523	13,955,295	3,341,721	12,197	485,253	12,851,716	41,460,826

[1] Philippine Islands and Puerto Rico excluded.
[2] From magnetite-pyrite-chalcopyrite ore.

Gold and silver produced in the United States from ore and old tailings, in 1943, by States and by methods of recovery, in terms of recovered metals[1]

State	Total ore, old tailings, etc., treated (short tons)	Ore, old tailings, etc., to amalgamation and cyanidation mills and bullion recovered				Ore and old tailings to concentrating mills (short tons)	Concentrates smelted (from amalgamation and cyanidation and concentrating mills combined)			Crude ore to smelters		
		Ore (short tons)	Old tailings, etc. (short tons)	Gold (fine ounces)	Silver (fine ounces)		Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Western States and Alaska:												
Alaska	1, 483, 527	1, 481, 644	...	47, 623	10, 041	1, 875	1, 215	9, 830	27, 593	8	19	52
Arizona	[2] 32, 908, 862	140, 842	3, 500	4, 776	25, 785	30, 986, 501	1, 420, 677	89, 015	2, 501, 717	1, 778, 019	77, 700	3, 186, 373
California	739, 957	246, 252	155, 266	20, 184	20, 346	272, 831	52, 714	30, 364	246, 280	65, 608	8, 355	336, 457
Colorado	1, 631, 318	800, 862	...	66, 306	24, 658	787, 827	154, 381	66, 108	2, 402, 438	42, 629	4, 623	236, 956
Idaho	2, 741, 747	55, 020	...	8, 742	4, 468	2, 669, 059	362, 690	19, 410	11, 565, 250	17, 668	2, 401	130, 393
Montana	[3] 5, 873, 016	34, 926	...	5, 097	1, 578	5, 327, 448	585, 456	23, 469	7, 118, 583	[3] 510, 642	16, 948	1, 328, 850
Nevada	8, 364, 043	398, 021	22, 622	50, 286	334, 185	7, 798, 687	284, 225	75, 060	715, 331	144, 713	7, 867	566, 330
New Mexico	8, 329, 043	140	...	62	21	8, 231, 359	360, 796	3, 581	376, 853	97, 544	1, 828	86, 684
Oregon	2, 680	201	...	316	101	1, 650	200	155	8, 776	829	418	1, 618
South Dakota	204, 932	202, 018	...	106, 389	32, 688	2, 914	206	55	3, 198	...	...	...
Texas	4, 134	...	...	...	...	...	...	...	...	4, 134	4	10, 284
Utah	[4] 37, 386, 731	...	...	...	...	36, 880, 347	1, 277, 578	352, 774	7, 464, 694	[4] 506, 384	37, 692	2, 014, 646
Washington	1, 131, 281	51, 135	...	2, 083	10, 770	1, 069, 745	66, 465	60, 944	347, 432	10, 401	2, 101	12, 221
Wyoming	...	...	...	...	...	...	...	...	...	...	...	...
	[5] 100, 801, 271	3, 411, 061	181, 388	311, 864	464, 641	94, 030, 243	4, 566, 603	730, 765	32, 778, 145	3, 178, 579	159, 956	7, 910, 873
Eastern States	[6] 4, 211, 961	...	...	...	...	4, 046, 093	82, 017	2, 361	81, 782	165, 868	505	46, 347
	[7] 105, 013, 232	3, 411, 061	181, 388	311, 864	464, 641	98, 076, 336	4, 648, 620	733, 126	32, 859, 927	3, 344, 447	160, 461	7, 957, 220

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.
[2] Excludes 3,721,926 tons of copper ore leached from which no gold or silver was recovered.
[3] Includes 225,261 tons of slag from which silver was recovered.
[4] Includes 109,012 tons of slag from which gold and silver were recovered.
[5] Excludes copper ore leached from Arizona, includes slag from Montana and Utah.
[6] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania, which Bureau of Mines is not at liberty to publish.
[7] Excludes copper ore leached from Arizona; includes slag from Montana and Utah; excludes magnetite ore from Pennsylvania.

Gold and silver produced at amalgamation and cyanidation mills in the United States and percentage of gold and silver recovered from all sources, 1939–43 [1]

Year	Bullion and precipitates recovered (fine ounces)				Percent of gold and silver from all sources [1]							
	Amalgamation		Cyanidation		Amalgamation		Cyanidation		Smelting [2]		Placers	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1939	985,717	243,786	1,043,675	4,556,336	21.1	0.4	22.3	7.1	28.0	92.2	28.6	0.3
1940	959,452	248,112	1,044,014	5,251,162	19.7	.3	21.4	7.5	27.9	91.9	31.0	.3
1941	916,113	214,665	1,005,031	5,157,702	19.3	.3	21.1	7.7	28.3	91.7	31.3	.3
1942	623,319	140,192	698,817	3,008,490	18.0	.2	20.2	5.6	32.5	93.9	29.3	.3
1943	168,772	44,114	143,092	420,528	12.4	.1	10.5	1.0	65.5	98.9	11.6	(3)

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.

[2] Both crude ores and concentrates.

[3] Less than 0.1 percent.

Gold and silver produced at amalgamation and cyanidation mills in the United States in 1943, by States [1]

State	Amalgamation			Cyanidation			Percent of gold and silver from all sources in State			
	Ore, old tailings, concentrates, etc., treated (short tons)	Bullion recovered (fine ounces)		Ore, old tailings, concentrates, sands, slimes, etc., treated (short tons)	Bullion and precipitates recovered		Amalgamation		Cyanidation	
		Gold	Silver		Gold	Silver	Gold	Silver	Gold	Silver
Alaska	1,481,644	47,623	10,041	------	------	------	47.82	23.47	------	------
Arizona	4	21	3	144,338	4,755	25,783	(2)	(2)	0.03	(2)
California	199,088	12,145	3,956	202,430	8,039	16,390	8.19	.65	5.42	2.69
Colorado	650,601	27,670	10,245	280,441	38,636	14,413	20.11	.39	28.09	.54
Idaho	55,020	8,742	4,468	------	------	------	28.38	(2)	------	------
Montana	757	273	18	16,623	4,824	1,560	.46	(2)	8.10	.18
Nevada	1,521	2,253	1,631	419,122	48,033	332,554	1.56	.10	33.25	20.52
New Mexico	140	62	21	------	------	------	1.12	(2)	------	------
Oregon	111	273	91	90	43	10	24.89	.86	3.92	.10
South Dakota	183,246	69,710	13,640	197,090	36,679	19,048	65.49	38.01	34.46	53.08
Texas	------	------	------	------	------	------	------	------	------	------
Utah	------	------	------	------	------	------	------	------	------	------
Washington	------	------	------	47,004	2,083	10,770	------	------	3.19	2.91
Wyoming	------	------	------	------	------	------	------	------	------	------
Eastern States	------	------	------	------	------	------	------	------	------	------
	2,572,132	168,772	44,114	1,307,138	143,092	420,528	12.37	.11	10.49	1.01

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.

[2] Less than 0.005 percent.

PLACERS

Dredging.—Placer gold is obtained largely from gravels handled by connected-bucket floating dredges, which recovered approximately 69 percent of the total output from placers in the United States (Philippine Island and Puerto Rico excluded) in 1943 and 68 percent in 1942. The quantity of gold recovered by dredges from the inception of the industry as a commercial factor in 1896 to the end of 1943 is recorded as 19,183,997 ounces, originating by States as follows: California, 11,633,915 ounces; Alaska, 5,176,618 (including the production from single-dipper dredges and some gold by hydraulicking); Montana, 704,662; Idaho, 612,271; Colorado, 455,195; Oregon, 467,046; and other States, 134,295.

The following tables show the connected-bucket floating dredges operated in the United States in 1942–43 and the gold produced by them in 1939–43.

Additional information on gold output by other placer-mining methods may be found in the State reviews in this volume.

Connected-bucket floating gold dredges operated in the United States, 1942–43, by companies and districts

ALASKA

Company	Address	District	Number of dredges	
			1942	1943
Alluvial Golds, Inc	Fairbanks	Circle	1	1
C. J. Berry Dredging Co	Miller House	do	1	------
Gold Placers, Inc	Fairbanks	do	1	------
Alaska Placer Co	Council	Council-Bluff	1	------
Camp Creek Dredging Co	do	do	1	------
Council Dredging Co	do	do	------	1
Inland Dredging Co	do	do	1	------
Brinker-Johnson Co	Fairbanks	Fairbanks	1	------
United States Smelting, Refining & Mining Co., Fairbanks Department.	do	do	7	------
Arctic Circle Exploration, Inc	Candle	Fairhaven	2	1
Dry Creek Dredging Co	Deering	do	1	1
Forsgren Dredging Co	do	do	1	------
North American Dredging Co	Flat	Iditarod	1	------
J. E. Riley Investment Co	do	do	1	------
Ganes Mining Co	Ophir	Innoko	1	1
Moss & Larson Mining Co	do	do	1	------
Nels J. Vibe	do	do	1	------
Castleton & Keenan (Kougarok Consolidated Placers, Inc.).	Nome	Kougarok	1	------
Fox Bar Dredging Co	do	do	1	------
Casa de Paga Gold Co	do	Nome	1	------
Lee Brothers Dredging Co	Solomon	do	1	1
United States Smelting, Refining & Mining Co., Nome Department.	Nome	do	2	------
New York Alaska Gold Dredging Co	Nyac	Tuluksak-Aniak	2	1
			31	7

CALIFORNIA

Company	Address	District	1942	1943
Poverty Hill Partnership	San Francisco	Brandy City	1	------
Lancha Plana Gold Dredging Co	Lockeford	Butte Creek	1	------
Yuba Consolidated Gold Fields	San Francisco	Callahan	1	------
Gold Hill Dredging Co	do	Camanche	2	2
Cosumnes Gold Dredging Co	do	Cosumnes River	1	------
Capital Dredging Co	do	Folsom	2	------
Lancha Plana Gold Dredging Co	do	do	1	------
Natomas Co	do	do	7	2
French Gulch Dredging Co	do	French Gulch	1	------
Thurman Gold Dredging Co	do	Igo	1	------
Junction City Mining Co	Junction City	Junction City	1	------
Yreka Gold Dredging Co	San Francisco	Klamath River	1	------
La Grange Gold Dredging Co	do	La Grange	1	------
Tuolumne Gold Dredging Co	do	do	1	1
Yuba Consolidated Gold Fields	do	do	1	------
Roseville Gold Dredging Co	do	Ophir	1	------
Gold Hill Dredging Co	do	Oroville	1	------
Oroville Gold Dredging Co	Oroville	do	1	1
Yuba Consolidated Gold Fields	San Francisco	do	4	------
Klamath Dredging Co	Orleans	Orleans	1	------
Rand Gold Dredging Associates	San Francisco	Randsburg	1	1
Williams Bar Dredging Co	Marysville	Smartville	1	1
Merced Dredging Co	San Francisco	Snelling	1	------
San Joaquin Mining Co	do	do	1	------
Snelling Gold Dredging Co	do	do	2	------
Carrville Gold Co	do	Trinity Center	1	------
Yuba Consolidated Gold Fields	do	Yuba River	6	2
			44	10

COLORADO

Company	Address	District	1942	1943
Timberline Dredging Co	Fairplay	Beaver Creek	1	------
Blue River Co	Breckenridge	Breckenridge	1	------
South Platte Dredging Co	Fairplay	Fairplay	1	------
			3	------

Connected-bucket floating gold dredges operated in the United States, 1942–43, by companies and districts—Continued

IDAHO

Company	Address	District	Number of dredges	
			1942	1943
Fisher-Baumhoff Co. (2 dredges)	Centerville	Boise Basin	2	......
Boise King Placers	Twin Springs	Middle Boise	1	......
Northwest Goldfields	Harvard	Hoodoo	1	......
Idaho-Canadian Dredging Co	Idaho City	Boise Basin	1	......
Snake River Mng. Co	Sunbeam	Yankee Fork	1	......
H. & H. Mines	Elk City	Elk City	1	......
Idaho Warren Dredging Co	North Fork	Gibbonsville	1	......
W. W. Prather	Warren	Warren	1	......
Mt. Vernon Gold Mng. Co	Elk City	Elk City	1	......
			10	......

MONTANA

Company	Address	District	1942	1943
H and H Mines	Portland	Henderson	......	1
Winston Bros. Co	Helena	Clancey	1	......
Porter Bros. Corporation	do	First Chance	1	1
Perry-Schroeder Mining Co	do	Missouri River	1	1
Emigrant Dredging Co	Emigrant	Emigrant	1	......
Star Pointer Exploration Co	Bearmouth	First Chance	1	......
Gold Creek Mng. Co	Deer Lodge	Washington	1	......
Homer Wilson (Norwegian dredge)	Harrison	Norris & Norwegian	1	......
			7	3

NEVADA

Company	Address	District	1942	1943
Manhattan Gold Dredging Co	San Francisco	Manhattan	1	1

OREGON

Company	Address	District	1942	1943
Western Gold Dredging Co	San Francisco	Canyon	1	......
Pleasant Creek Mining Corporation	Seattle	Gold Hill	1	......
Porter and Co	Granite	Granite	1	......
Sunshine Mining Co. (Burnt River Division)	Baker	Greenhorn	1	......
Timms Gold Dredging Co	Bates	do	1	......
Sumpter Valley Dredging Co	Sumpter	Sumpter	1	......
			6	......

Gold produced in the United States by connected-bucket floating dredges, 1939–43, in fine ounces

Year	Dredges	California	Alaska	Other States[1]	Total
1939	114	370,264	304,995	112,472	787,731
1940	122	414,966	354,806	134,377	904,149
1941	123	418,282	307,087	141,636	867,005
1942	102	310,937	249,868	128,264	689,069
1943	21	66,999	18,554	24,373	109,929

[1] Colorado, Idaho, Montana, Nevada and Oregon.

EMPLOYMENT AND PRODUCTION IN 1942

Outstanding features in employment and production in gold and silver mines in the United States in 1942 compared with 1941 were the closing of nearly half of the mines; a reduction of nearly 50 percent in the average number of employees; a decline almost as great in the number of man-hours of labor performed; slight increases in the number of operating days per mine, the average workyear per man, and the number of tons of ore produced per mine; and a reduction in the number of man-hours required to mine a ton of ore.

Number of mines.—All sections of the country experienced pronounced declines in the number of gold and silver mines operating in 1942. For the whole United States the number producing gold ore and gold-silver ore fell 51 percent from 1941; silver ore 45 percent; and all gold and silver ores, 50 percent. New Mexico showed the greatest reduction, 63 percent. The severest slump was in the group of small mines—those employing only a few men and producing at most only a few hundred tons of ore annually.

Tons of ore produced per mine.—Even though half of the mines producing gold and silver ores in 1941 did not operate in 1942, the half that did operate had a greater average output of ore per mine than all the mines that produced in 1941. This was because many of the smaller mines closed, leaving the larger ones to carry the load of production. Increases in average output per mine were registered in Arizona, California, Colorado, Idaho, Nevada, South Dakota, Washington, and the Eastern States; declines were noted in Montana, New Mexico, Oregon, Texas, Utah, and Alaska. For the whole United States the increase was from 4,829 tons per mine in 1941 to 6,334 tons in 1942, a rise of nearly 24 percent.

Operating time (days per mine).—In normal years hundreds of small gold and silver mines operate only for a few weeks in the year. In 1942 most of these failed to open so that the effect was to increase the average number of days worked by the remaining mines. States showing increases were Arizona, Colorado, Idaho, Nevada, Utah, and Washington; decreases, California, Montana, New Mexico, Oregon, South Dakota, Texas, Eastern States, and Alaska. For the entire United States, in 1942, the average gold and silver mine operated 248 days compared with 239 in 1941.

Average workyear per man.—Although the number of employees and man-hours expended in mining gold and silver ores decreased greatly in 1942, the workyear per man increased. The workyear declined for gold ore but increased for gold-silver and silver ores, so that for the whole industry the number of hours increased from 1,916 in 1941 to 1,986 in 1942. Marked decreases occurred in New Mexico (1,860 in 1941; 1,209 in 1942), Texas (2,450 in 1941; 1,663 in 1942), and the Eastern States (2,522 in 1941; 1,794 in 1942), and smaller decreases in California, Montana, Oregon, South Dakota and Alaska.

Average number of men.—Workers in the gold and silver lode mines were only a little more than half as numerous (53 percent) in 1942 as in 1941. Oregon experienced the greatest loss (75 percent) and Texas the least (less than 4 percent). Placer workers declined 37 percent.

Man-hours.—Closely paralleling the decline in employees was the decline in man-hours of labor performed (45 percent for the country as a whole). The drop was greatest in Oregon (79 percent); New Mexico followed closely, with 68 percent. Although the number of employees in Washington fell 35 percent, man-hours of labor performed dropped only 8 percent. No other State approached this low figure. Texas, with a reduction of less than 3 percent in average number of employees, experienced a slump of nearly 35 percent in man-hours of labor performed.

Man-hours per ton of ore mined.—In the majority of States, mining 1 ton of gold and silver ores required fewer man-hours in 1942 than in 1941, probably due in considerable part to curtailment or stoppage of development brought about by labor shortages, so that employees devoted a greater proportion of their time to removing ore from the mines.

Employment and production in gold and silver lode mines and mills in the United States in 1942, by classes of ore and by States or regions

GOLD ORE

State or region	Number of mines	Employment									
		Average number of men					Man-hours				
		Mine			Mill	Total	Mine			Mill	Total
		Under-ground	Surface [1]	Total			Under-ground	Surface [1]	Total		
Western States:											
Arizona	216	558	109	667	218	885	1, 150, 185	180, 130	1, 330, 315	452, 486	1, 782, 801
California	376	2, 489	781	3, 270	749	4, 019	4, 624, 165	1, 467, 700	6, 091, 865	1, 333, 758	7, 425, 623
Colorado	156	989	274	1, 263	402	1, 665	2, 072, 850	573, 090	2, 645, 940	936, 090	3, 582, 030
Idaho	88	222	43	265	47	312	483, 661	79, 529	563, 190	102, 024	665, 214
Montana (incl. Wyoming)	185	502	113	615	133	748	751, 692	177, 998	929, 690	260, 181	1, 189, 871
Nevada	231	536	265	801	279	1, 080	1, 026, 064	637, 433	1, 663, 497	616, 094	2, 309, 591
New Mexico	9	21	6	27	4	31	23, 945	6, 100	30, 045	7, 000	37, 045
Oregon (including State gold-silver ore)	48	103	17	120	51	171	154, 220	26, 161	180, 384	45, 522	225, 906
South Dakota	4	1, 105	253	1, 358	237	1, 595	1, 984, 991	406, 679	2, 391, 670	464, 574	2, 856, 244
Utah	19	87	36	123	54	177	172, 763	61, 818	234, 581	110, 120	344, 701
Washington	18	101	36	137	36	173	237, 227	64, 898	302, 125	68, 551	370, 676
	1, 350	6, 713	1, 933	8, 646	2, 210	10, 856	12, 681, 763	3, 681, 539	16, 363, 302	4, 426, 400	20, 789, 702
Alaska (including gold-silver ore from Alaska)	38	429	217	646	209	855	1, 047, 200	595, 080	1, 642, 280	533, 736	2, 176, 016
Eastern States	13	37	89	126	34	160	67, 700	158, 348	226, 048	66, 800	292, 848
	1, 401	7, 179	2, 239	9, 418	2, 453	11,871	13, 796, 663	4, 434, 967	18, 231, 630	5, 026, 936	23, 258, 566
Total, 1941	2, 845	13, 498	5, 024	18, 522	3, 146	21, 668	26, 182, 962	10, 144, 124	36, 327, 086	7, 178, 494	43, 505, 580

See footnotes at end of table.

***Employment and production in gold and silver lode mines and mills in the United States in 1942, by classes of ore and by States or regions*—Con.**

GOLD ORE—Continued

State or region	Production								Man-hours			
	Ore (short tons)		Gold (fine ounces)	Silver (fine ounces)	Total value (including value of base metals recovered)	Percent of total value from—			Per ton of ore		Per ounce of gold and silver	
	Produced	Milled				Gold	Silver	Base metals	Mined	Milled	Mined	Milled
Western States:												
Arizona	498, 879	482, 272	83, 586	123, 520	$3, 205, 998	91. 3	2. 7	6. 0	2. 67	0. 94	6. 42	2. 74
California	2, 021, 543	1, 997, 636	359, 942	640, 073	13, 080, 246	96. 3	3. 5	. 2	3. 01	. 67	6. 09	1. 37
Colorado	932, 145	926, 910	188, 682	293, 231	7, 096, 427	93. 1	2. 9	4. 0	2. 84	1. 01	5. 49	2. 01
Idaho	142, 952	140, 686	35, 452	130, 336	1, 342, 573	92. 4	6. 9	. 7	3. 94	. 73	3. 40	. 63
Montana (incl. Wyoming)	322, 199	282, 930	69, 385	165, 163	2, 580, 792	94. 1	4. 6	1. 3	2. 89	. 92	3. 96	2. 13
Nevada	897, 769	879, 218	136, 793	260, 775	4, 979, 056	96. 2	3. 7	. 1	1. 85	. 73	4. 18	1. 82
New Mexico	5, 718	5, 282	1, 155	4, 378	52, 285	77. 3	6. 0	16. 7	5. 25	1. 33	5. 43	2. 08
Oregon (including State gold-silver ore)	31, 670	25, 755	7, 895	80, 218	359, 514	76. 8	15. 9	7. 3	5. 70	1. 77	2. 05	. 60
South Dakota	1, 454, 387	1, 454, 387	521, 900	179, 389	18, 394, 066	99. 3	. 7	--------	1. 64	. 32	3. 41	. 66
Utah	126, 405	96, 302	20, 588	35, 814	771, 889	93. 4	3. 3	3. 3	1. 86	1. 14	4. 16	13. 47
Washington	93, 957	72, 807	26, 524	165, 960	1, 047, 679	88. 6	11. 3	. 1	3. 22	. 94	1. 57	. 42
	6, 527, 624	6, 364, 185	1, 451, 902	2, 078, 857	52, 910, 525	96. 0	2. 8	1. 2	2. 51	. 70	4. 63	1. 39
Alaska (including gold-silver ore from Alaska)	2, 816, 668	2, 816, 668	137, 499	68, 798	4, 922, 322	97. 8	1. 0	1. 2	. 58	. 19	7. 96	2. 59
Eastern States	106, 555	106, 555	11, 861	7, 606	420, 665	98. 7	1. 3	--------	2. 12	. 63	11. 61	3. 43
	9, 450, 847	9, 287, 408	1, 601, 262	2, 155, 261	58, 253, 512	96. 2	2. 6	1. 2	1. 93	. 54	4. 85	1. 47
Total, 1941	15, 117, 117	14, 843, 603	2, 403, 134	3, 478, 518	87, 437, 933	96. 2	2. 8	1. 0	2. 40	. 48	6. 18	1. 41

GOLD-SILVER ORE

State or region	Number of mines	Employment									
		Average number of men					Man-hours				
		Mine			Mill	Total	Mine			Mill	Total
		Under-ground	Surface [1]	Total			Under-ground	Surface [1]	Total		
Western States:											
Arizona	28	131	28	159	13	172	241, 869	58, 329	300, 198	31, 222	331, 420
California	7	48	16	64	13	77	101, 856	34, 360	136, 216	32, 304	168, 520
Colorado	27	198	60	258	91	349	435, 376	139, 624	575, 000	193, 160	768, 160
Idaho	7	170	77	247	56	303	341, 464	169, 088	510, 552	115, 088	625, 640
Montana	45	29	31	60	3	63	50, 104	65, 600	115, 704	3, 600	119, 304
Nevada	60	224	49	273	93	366	542, 942	100, 564	643, 506	191, 994	835, 500
New Mexico	14	99	14	113	27	140	120, 080	20, 481	140, 561	41, 149	181, 710
Oregon (incl. under gold ore)	------	------	------	------	------	------	------	------	------	------	------
Utah	27	186	46	232	------	232	412, 635	100, 251	512, 886	------	512, 886
Total	215	1, 085	321	1, 406	296	1, 702	2, 246, 326	688, 297	2, 934, 623	608, 517	3, 543, 140
Alaska (incl. under gold ore)	------	------	------	------	------	------	------	------	------	------	------
	215	1, 085	321	1, 406	296	1, 702	2, 246, 326	688, 297	2, 934, 623	608, 517	3, 543, 140
Total, 1941	435	2, 225	590	2, 815	388	3, 203	3, 834, 237	1, 050, 910	4, 885, 147	952, 230	5, 837, 377

See footnotes at end of table.

Employment and production in gold and silver lode mines and mills in the United States in 1942, by classes of ore and by States or regions—Con.

GOLD-SILVER—Continued

State or region	Production											
	Ore (short tons)		Gold (fine ounces)	Silver (fine ounces)	Total value (includes value of base metals recovered)	Percent of total value from			Man-hours			
	Produced	Milled				Gold	Silver	Base metals	Per ton of ore		Per ounce of gold and silver	
									Mined	Milled	Mined	Milled
Western States:												
Arizona	124, 668	67, 757	9, 691	379, 480	$696, 749	48. 7	38. 7	12. 6	2. 41	0. 46	0. 77	0. 59
California	41, 677	41, 538	17, 475	376, 832	880, 334	69. 5	30. 4	. 1	3. 27	. 78	. 35	. 08
Colorado	192, 709	190, 435	25, 077	399, 586	1, 518, 073	57. 8	18. 7	23. 5	2. 98	1. 01	1. 35	. 47
Idaho	173, 389	172. 137	7, 494	358, 263	521, 508	50. 3	48. 8	. 9	2. 95	. 67	1. 40	. 35
Montana	77, 231	2, 150	8, 224	489, 357	692, 266	41. 6	50. 3	8. 1	1. 50	1. 67	1. 29	. 13
Nevada	339, 645	308, 278	26, 708	1, 253, 561	1, 854, 927	50. 4	48. 1	1. 5	1. 89	. 62	. 50	. 24
New Mexico	29, 997	27. 150	4, 112	267, 298	335, 557	42. 9	56. 6	. 5	4. 69	1. 52	. 52	. 18
Oregon (incl. under gold ore)	....	....	....	....	....	....	....	....	....	....	....	....
Utah	224, 420	....	15, 933	879, 892	1, 766, 416	31. 6	35. 4	33. 0	2. 29	....	. 57	....
	1, 203, 736	809, 445	114, 714	4, 404, 269	8, 265, 830	48. 6	37. 9	13. 5	2. 44	. 75	. 65	. 27
Alaska (incl. under gold ore)	....	....	....	....	....	....	....	....	....	....	....	....
	1, 203, 736	809, 445	114, 714	4, 404, 269	8, 265, 830	48. 6	37. 9	13. 5	2. 44	. 75	. 65	. 27
Total, 1941	1, 447, 375	992, 038	162, 810	7, 149, 036	11, 849, 973	48. 1	42. 9	9. 0	3. 38	. 96	. 67	. 23

SILVER ORE

State or region	Number of mines	Employment: Average number of men: Mine: Underground	Mine: Surface[1]	Mine: Total	Mill	Total	Man-hours: Mine: Underground	Mine: Surface[1]	Mine: Total	Mill	Total
Western States:											
Arizona	36	55	22	77	3	80	118,230	45,532	163,762	2,100	165,862
California	16	33	10	43	8	51	59,000	18,000	77,000	13,160	90,160
Colorado	26	154	42	196	31	227	341,173	91,232	432,405	60,187	492,592
Idaho	18	630	172	802	71	873	1,448,810	407,264	1,856,074	159,191	2,015,265
Montana	54	231	48	279	30	309	489,314	109,324	598,638	73,820	672,458
Nevada	56	141	22	163	22	185	303,521	44,434	347,955	48,050	396,005
New Mexico	4	10	1	11		11	11,000	1,100	12,100		12,100
Oregon (incl. under gold ore)											
Texas	3	230	22	252	53	305	382,698	36,480	419,178	103,070	522,248
Utah	21	134	46	180	1	181	299,024	96,500	395,524	200	395,724
Total, 1941	234	1,618	385	2,003	219	2,222	3,452,770	849,866	4,302,636	459,778	4,762,414
	425	2,218	397	2,615	214	2,829	3,989,972	711,616	4,701,588	495,266	5,196,854

See footnotes at end of table.

Employment and production in gold and silver lode mines and mills in the United States in 1942, by classes of ore and by States or regions—Con.

SILVER ORE—Continued

State or region	Production								Man-hours			
	Ore (short tons)		Gold (fine ounces)	Silver (fine ounces)	Total value (includes value of base metals recovered)	Percent of total value from			Per ton of ore		Per ounce of gold and silver	
	Produced	Milled				Gold	Silver	Base metals	Mined	Milled	Mined	Milled
Western States:												
Arizona	34, 395	1, 451	1, 033	422, 306	$342, 977	10. 5	87. 6	1. 9	4. 76	1. 45	0. 39	0. 17
California	13, 331	11, 997	285	69, 342	99, 823	10. 0	49. 4	40. 6	5. 78	1. 10	1. 11	. 52
Colorado	88, 132	56, 260	2, 407	1, 428, 333	1, 379, 057	6. 1	73. 7	20. 2	4. 91	1. 07	. 30	. 07
Idaho	458, 533	447, 130	331	7, 528, 893	6, 021, 543	. 2	88. 9	10. 9	4. 05	. 36	. 25	. 02
Montana	134, 153	49, 735	3, 395	1, 573, 091	1, 490, 629	8. 0	75. 0	17. 0	4. 46	1. 47	. 38	. 13
Nevada	79, 996	63, 170	2, 801	904, 577	761, 648	12. 9	84. 5	2. 6	4. 35	. 76	. 38	. 07
New Mexico	2, 116		114	43, 459	34, 894	11. 4	88. 6		5. 72		. 28	
Oregon (incl. under gold ore)												
Texas	100, 052	96, 481	235	667, 454	522, 698	1. 6	90. 8	7. 6	4. 19	1. 07	. 63	. 15
Utah	83, 409	100	3, 059	960, 006	1, 080, 448	9. 9	63. 2	26. 9	4. 74	2. 00	. 41	1. 20
	994, 117	726, 324	13, 660	13, 597, 461	11, 733, 717	4. 1	82. 4	13. 5	4. 32	. 63	. 32	. 04
Total, 1941	1, 074, 539	809, 836	16, 572	16, 981, 973	13, 963, 695	4. 2	86. 5	9. 3	4. 38	. 61	. 28	. 04

SUMMARY

State or region	Number of mines	Employment									
		Average number of men					Man-hours				
		Mine			Mill	Total	Mine			Mill	Total
		Underground	Surface [1]	Total			Underground	Surface [1]	Total		
Western States:											
Arizona	[2] 278	744	159	903	234	1, 137	1, 510, 284	283, 991	1, 794, 275	485, 808	2, 280, 083
California	[2] 398	2, 570	807	3, 377	772	4, 149	4, 785, 021	1, 520, 060	6, 305, 081	1, 379, 222	7, 684, 303
Colorado	209	1, 341	876	1, 717	524	2, 241	2, 849, 399	803, 946	3, 653, 345	1, 189, 437	4, 842, 782
Idaho	[2] 112	1, 022	292	1, 314	174	1, 488	2, 273, 935	655, 881	2, 929, 816	376, 303	3, 306, 119
Montana (incl. Wyoming)	284	762	192	954	166	1, 120	1, 291, 110	352, 922	1, 644, 032	337, 601	1, 981, 633
Nevada	[2] 341	901	336	1, 237	394	1, 631	1, 872, 527	782, 431	2, 654, 958	886, 138	3, 541, 096
New Mexico	27	130	21	151	31	182	155, 025	27, 681	182, 706	48, 149	230, 855
Oregon	[2] 47	103	17	120	51	171	154, 220	26, 164	180, 384	45, 522	225, 906
South Dakota	4	1, 105	253	1, 358	237	1, 595	1, 984, 991	406, 679	2, 391, 670	464, 574	2, 856, 244
Texas	3	230	22	252	53	305	382, 698	36, 480	419, 178	103, 070	522, 248
Utah	67	407	128	535	55	590	884, 422	258, 569	1, 142, 991	110, 320	1, 253, 311
Washington	18	101	36	137	36	173	237, 227	64, 898	302, 125	68, 551	370, 676
	1, 788	9, 416	2, 639	12, 055	2, 727	14, 782	18, 390, 859	5, 219, 702	23, 600, 561	5, 494, 695	29, 095, 256
Alaska	38	429	217	640	209	855	1, 047, 200	595, 080	1, 642, 280	533, 736	2, 176, 016
Eastern States	13	37	89	126	34	160	67, 700	158, 348	226, 048	66, 800	292, 848
	1. 839	9, 882	2, 945	12, 827	2, 970	15, 797	19, 495, 759	5, 973, 130	25, 468, 889	6, 095, 231	31, 564, 120
Total, 1941	3, 652	17, 941	6, 011	23, 952	3, 748	27, 700	34, 007, 171	11, 906, 650	45, 913, 821	8, 625, 990	54, 139, 811

See footnotes at end of table.

Employment and production in gold and silver lode mines and mills in the United States in 1942, by classes of ore and by States or regions—Con.

SUMMARY—Continued

State or region	Production								Man-hours			
	Ore (short tons)		Gold (fine ounces)	Silver (fine ounces)	Total value (includes value of base metals recovered)	Percent of total value from—			Per ton of ore		Per ounce of gold and silver	
	Produced	Milled				Gold	Silver	Base metals	Mined	Milled	Mined	Milled
Western States:												
Arizona	657,942	551,480	94,310	925,306	$4,245,724	77.7	15.5	6.8	2.73	0.88	1.76	2.11
California	2,076,551	2,051,171	377,702	1,086,247	14,060,403	94.0	5.5	.5	3.04	.67	4.31	.99
Colorado	1,212,986	1,173,605	216,166	2,121,150	9,993,557	75.7	15.1	9.2	3.01	1.01	1.56	.66
Idaho	774,874	759,953	43,277	8,017,492	7,885,624	19.2	72.3	8.5	3.78	.50	.36	.05
Montana (incl. Wyoming)	533,583	334,815	81,004	2,227,611	4,763,687	59.5	33.3	7.2	3.08	1.01	.71	.46
Nevada	1,317,410	1,250,640	166,302	2,418,913	7,595,643	76.6	22.6	.7	2.02	.71	1.08	.48
New Mexico	37,831	32,432	5,381	315,135	422,736	44.6	53.0	2.4	4.83	1.48	.57	.21
Oregon	31,670	25,755	7,895	80,218	359,514	76.9	15.9	7.3	5.70	1.77	2.05	.60
South Dakota	1,454,387	1,454,387	521,900	179,389	18,394,066	99.3	.7	-------	1.64	.32	3.41	.66
Texas	100,052	96,481	235	667,454	522,698	1.6	90.8	7.6	4.19	1.07	.63	.15
Utah	434,234	96,402	39,580	1,875,712	3,618,753	38.3	36.9	24.9	2.63	1.14	.60	12.26
Washington	93,957	72,807	26,524	165,960	1,047,679	88.6	11.3	.1	3.22	.94	1.57	.42
	8,725,477	7,899,928	1,580,276	20,080,587	72,910,084	75.9	19.6	4.6	2.70	.70	1.09	.35
Alaska	2,816,668	2,816,668	137,499	68,798	4,922,322	97.8	1.0	1.2	.58	.19	7.96	2.59
Eastern States	106,555	106,555	11,861	7,606	420,665	98.7	1.3	-------	2.12	.63	11.61	3.43
	11,648,700	10,823,151	1,729,636	20,156,991	78,253,071	77.4	18.3	4.3	2.19	.56	1.16	.38
Total, 1941	17,639,031	16,645,477	2,582,516	27,609,527	113,251,601	79.8	17.3	2.9	2.60	.52	1.52	.38

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[1] Includes open-cut workers.

[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Employment and production in gold placer mines in the United States in 1942

State or region	Number of mines	Employment: Average number of men: Dredging	Employment: Average number of men: Hydraulicking	Employment: Average number of men: Other[1]	Employment: Average number of men: Total	Employment: Man-hours: Dredging	Employment: Man-hours: Hydraulicking	Employment: Man-hours: Other	Employment: Man-hours: Total	Production: Gold (ounces)	Production: Silver (ounces)	Production: Total value	Production: Man-hours per ounce of gold and silver
Western States:													
Arizona	163	17	-	147	164	24, 560	-	80, 788	105, 348	2, 836	398	$99, 543	32. 6
California	428	2, 660	246	1, 163	4, 069	4, 277, 827	278, 977	1, 852, 994	6, 409, 798	464, 926	40, 635	16, 301, 306	12. 7
Colorado	68	102	3	99	204	147, 594	2, 920	134, 565	285, 079	22, 617	4, 202	794, 583	10. 6
Idaho	236	208	66	163	437	392, 122	61, 264	86, 784	540, 170	44, 580	10, 471	1, 567, 746	9. 8
Montana	170	194	7	193	394	337, 816	3, 752	160, 759	502, 327	41, 242	6, 937	1, 448, 403	10. 4
Nevada	49	142	10	98	250	377, 360	7, 574	109, 572	494, 506	47, 354	19, 980	1, 671, 598	7. 3
New Mexico	48	5	-	40	45	5, 000	-	41, 198	46, 198	1, 247	135	43, 741	33. 4
Oregon	83	340	133	127	600	588, 499	94, 277	165, 136	847, 912	38, 336	7, 141	1, 346, 838	18. 6
South Dakota	13	3	-	13	16	3, 056	-	3, 320	6, 376	33	3	1, 157	177. 1
Utah	6	-	-	9	9	-	-	5, 560	5, 560	32	-	1, 120	173. 7
Washington	18	12	1	15	28	6, 460	120	7, 056	13, 636	356	59	12, 502	32. 8
Wyoming	6	-	-	9	9	-	-	1, 920	1, 920	12	-	420	160. 0
	1, 288	3, 683	466	2, 076	6, 225	6, 160, 294	448, 884	2, 649, 652	9, 258, 830	663, 571	89, 961	23, 288, 957	12. 3
Alaska	453	1, 351	537	287	2, 175	2, 093, 880	429, 600	345, 400	2, 868, 880	350, 122	50, 906	12, 290, 470	7. 2
Eastern States	17	5	-	12	17	3, 900	-	2, 400	6, 300	69	2	2, 416	88. 7
	1, 758	5, 039	1, 003	2, 375	8, 417	8, 258, 074	878, 484	2, 997, 452	12, 134, 010	1, 013, 762	140, 869	35, 581, 843	10. 5
Total, 1941	3, 349	8, 216	2, 021	3, 131	13, 368	14, 366, 103	1, 868, 707	2, 941, 130	19, 175, 940	1, 487, 635	194, 128	52, 205, 272	11. 4

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[1] Includes employees in underground placers, small-scale hand operations, and surface shops and yards.

Employment and production in all gold and silver mines in the United States in 1942

SUMMARY

State or region	Number of mines	Employment		Production						Man-hours per ounce of gold and silver mined
		Men	Man-hours	Gold (ounces)	Silver (ounces)	Total value (includes base metals recovered)	Percent of total value from—			
							Gold	Silver	Base metals	
Western States:										
Arizona	[1] 441	1,067	1,899,623	97,146	925,704	$4,345,267	78.3	15.1	6.6	1.86
California	[1] 826	7,446	12,714,879	842,628	1,126,882	30,361,709	97.1	2.6	.2	6.45
Colorado	277	1,921	3,938,424	238,783	2,125,352	10,788,140	17.5	14.0	8.5	1.67
Idaho	[1] 348	1,751	3,469,986	87,857	8,027,963	9,453,370	32.5	60.4	7.1	.42
Montana	454	1,348	2,146,359	122,246	2,234,548	6,212,090	68.9	25.6	5.5	.91
Nevada	[1] 390	1,487	3,149,464	213,656	2,438,893	9,267,241	80.7	18.7	.6	1.19
New Mexico	75	196	228,904	6,628	315,270	466,477	49.7	48.1	2.2	.71
Oregon	[1] 130	720	1,028,296	46,231	87,359	1,706,352	94.8	3.6	1.5	7.70
South Dakota	17	1,374	2,398,046	521,933	179,392	18,395,223	99.3	.7	----------	3.42
Texas	3	252	419,178	235	667,454	522,698	1.6	90.8	7.6	.63
Utah	73	544	1,148,551	39,612	1,875,712	3,619,873	38.3	36.8	24.9	.60
Washington	36	165	315,761	26,880	166,019	1,060,181	88.7	11.1	.1	1.63
Wyoming [2]	6	9	1,920	12	----------	420	10.0	----------	----------	160.00
	3,076	18,280	32,859,391	2,243,847	20,170,548	96,199,041	81.6	14.9	3.5	1.47
Alaska	491	2,821	4,511,160	487,621	119,704	17,212,792	99.1	.5	.4	7.43
Eastern States	30	143	232,348	11,930	7,608	423,081	98.7	1.3	----------	11.89
	3,597	21,244	37,602,899	2,743,398	20,297,860	113,834,914	84.3	12.7	3.0	1.63
Total, 1941	7,001	37,320	65,089,761	4,070,151	27,803,655	165,456,873	86.1	11.9	2.0	2.04

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[2] Placer mines only; data on lode mines included with Montana.

WORLD ASPECTS

WORLD PRODUCTION

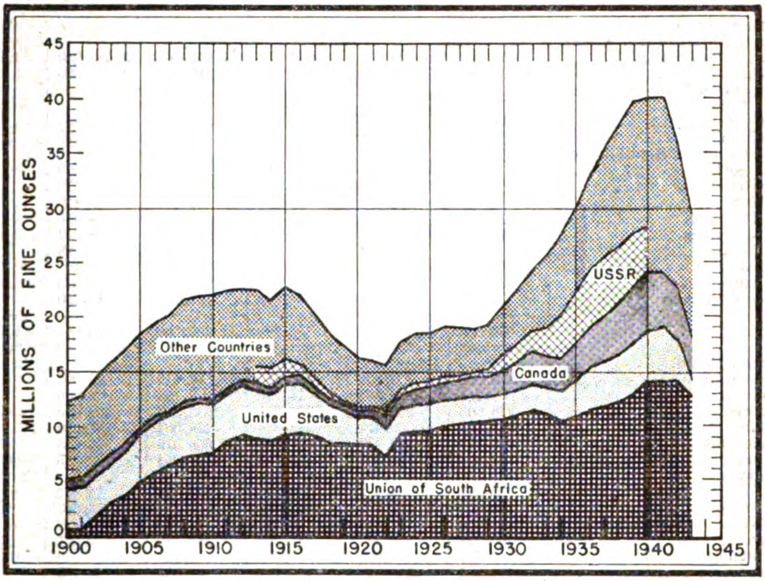

FIGURE 2.—World production of gold, 1900–43.

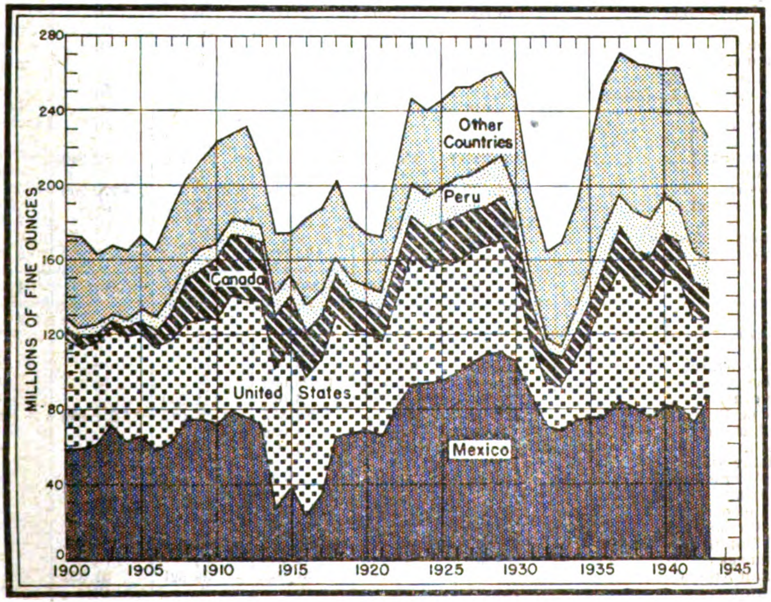

FIGURE 3.—World production of silver, 1900–43.

World production of gold, 1938–43, by countries, in fine ounces [1]

Country	1938	1939	1940	1941	1942	1943
North America:						
United States (incl. Alaska and Puerto Rico) [2]	4,245,377	4,620,602	4,862,979	4,832,087	3,583,080	1,394,522
Canada	4,725,117	5,094,379	5,311,145	5,345,179	4,841,306	3,649,671
Central America and West Indies:						
Costa Rica	[3] 17,489	[3] 15,863	[3] 16,156	[3] 16,891	[3] 14,864	[3] 6,957
Cuba	[4] 3,889	[4] 3,851	[4] 1,251	[4] 607	[4] 195	------------
Dominican Republic (exports)	5,275	6,304	6,914	15,614	6,709	816
Guatemala	5,466	5,058	4,447	2,560	729	409
Haiti	(5)	(5)	(5)	(5)	432	310
Honduras	21,879	22,216	23,173	22,822	34,256	(5)
Nicaragua	44,301	100,182	168,549	217,577	248,023	223,497
Panama	6,879	3,774	2,634	2,105	98	------------
Salvador	[3] 12,065	[3] 16,424	[3] 51,195	[3] 32,593	[3] 30,197	[3] 26,871
Mexico	923,819	841,642	883,117	799,975	801,325	634,752
Newfoundland	24,104	20,316	21,786	21,194	15,750	18,735
	[6] 10,036,000	[6] 10,751,000	[6] 11,353,700	[6] 11,309,500	9,576,964	[6] 6,000,000
South America:						
Argentina	6,752	9,806	10,288	17,619	20,994	(5)
Bolivia	[7] 9,255	[7] 7,884	[4] 11,749	[4] 8,158	[4] 5,905	[4] 4,304
Brazil	216,600	252,576	264,311	235,343	229,000	210,000
Chile	318,405	369,474	373,544	278,004	253,590	269,807
Colombia	520,717	570,017	631,927	656,019	596,618	565,501
Ecuador	74,042	85,352	52,942	70,264	102,416	[8] 100,000
Guiana:						
British	38,482	38,473	35,745	29,138	18,572	11,611
French	40,638	37,606	32,561	[4] 34,281	[4] 25,607	(5)
Netherlands (Surinam)	14,154	14,812	5,921	12,563	7,883	5,795
Peru	260,324	267,355	281,259	285,189	257,655	230,000
Uruguay	657	1,608	1,762	1,364	(5)	(5)
Venezuela	114,985	146,608	146,792	99,090	88,150	62,802
	1,615,011	1,801,571	1,848,801	1,727,032	[6] 1,606,600	[6] 1,499,000
Europe:						
Bulgaria	200	6,690	7,330	5,562	(5)	(5)
Czechoslovakia	[6] 10,000	[6] 10,000	9,067	(5)	(5)	(5)
Finland	3,858	1,822	(5)	(5)	(5)	(5)
France	87,354	[6] 85,000	(5)	(5)	(5)	(5)
Germany	8,650	(5)	(5)	(5)	(5)	(5)
Austria						
Hungary	5,655	5,079	(5)	(5)	(5)	(5)
Italy	5,016	(5)	(5)	(5)	(5)	(5)
Norway	55	(5)	(5)	(5)	(5)	(5)
Portugal	6,186	5,948	[6] 10,000	(5)	(5)	(5)
Rumania	157,924	153,616	130,286	104,230	82,240	(5)
Spain	6,955	[6] 30,000	[6] 15,000	(5)	(5)	(5)
Sweden	234,122	216,149	197,995	(5)	[8] 270,200	(5)
Switzerland	1,125	1,447	(5)	(5)	(5)	(5)
U. S. S. R	[6] 5,236,000	(5)	(5)	(5)	(5)	(5)
United Kingdom	2,428	6	------------	------------	------------	------------
Yugoslavia	78,318	71,503	[6] 75,000	(5)	(5)	(5)
	5,844,000	[6] 5,704,000	[6] 5,366,000	[6] 4,500,000	[8] 4,500,000	[8] 4,500,000
Asia:						
Burma	1,209	(9)	(9)	(9)	(9)	(9)
China	(5)	(5)	478,188	(5)	(5)	(5)
Manchuria	112,000	105,000	100,000	(5)	(5)	(5)
Chosen	948,447	975,000	1,025,000	(5)	(5)	(5)
Cyprus	[4] 29,245	[4] 16,393	13,621	[6] 12,500	(5)	(5)
India, British	321,138	[9] 316,504	[9] 289,357	[9] 285,945	[9] 257,039	[9] 252,353
Indochina	8,745	8,070	8,038	(5)	(5)	(5)
Japan	[6] 760,000	[6] 836,000	900,000	(5)	(5)	(5)
Malay States:						
Federated	40,209	40,283	35,689	(5)	(5)	(5)
Straits Settlements	5	8	6	(5)	(5)	(5)
Unfederated	581	880	479	(5)	(5)	(5)
Netherlands Indies	76,443	81,183	89,942	(5)	(5)	(5)
Philippine Islands	[10] 903,265	1,040,146	1,140,126	[10] 1,144,332	[10] 158,726	[10] 13,764
Sarawak	18,520	17,261	12,285	(5)	(5)	(5)
Saudi Arabia	(5)	15,985	31,965	36,521	31,352	42,643
Taiwan	145,000	(5)	(5)	(5)	(5)	(5)
Thailand (Siam)	13,620	12,711	12,717	(5)	(5)	(5)
	[6] 3,678,000	[6] 3,911,000	[6] 4,283,000	[6] 3,443,000	[6] 1,700,000	[8] 1,600,000

See footnotes at end of table.

World production of gold, 1938–43, by countries, in fine ounces—Continued

Country	1938	1939	1940	1941	1942	1943
Africa:						
Bechuanaland	19,111	17,219	18,015	14,509	15,441	(5)
Belgian Congo	455,264	522,450	555,404	[11] 561,030	[11] 499,944	[11] 453,300
Ruanda and Urundi	17,994	29,386	(5)	(11)	(11)	(11)
Cameroums French	15,542	(5)	(5)	20,544	20,747	19,618
Egypt	2,162	3,877	7,344	2,868	1,768	462
French Equatorial Africa	34,942	53,868	73,576	88,395	(5)	(5)
French West Africa (exports)	[4] 127,220	[6] 130,000	[4] 133,394	(5)	(5)	(5)
Gold Coast	677,480	793,099	886,326	885,110	784,478	565,000
Kenya Colony	70,102	77,444	77,243	70,732	(5)	(5)
Liberia (exports)	1,902	6,536	9,661	20,370	(5)	(5)
Madagascar	13,770	[6] 14,000	11,580	10,995	8,887	(5)
Morocco, French	7,491	(5)	(5)	(5)	(5)	(5)
Nigeria	24,815	25,794	25,617	(5)	(5)	(5)
Portuguese East Africa	11,654	13,386	13,386	[6] 13,500	(5)	(5)
Rhodesia:						
Northern	1,092	4,645	5,782	3,333	(5)	(5)
Southern	814,078	795,613	826,485	790,442	760,030	656,684
Sierra Leone	30,012	33,657	32,676	(5)	(5)	(5)
South-West Africa	1,796	1,484	1,244	531	(5)	(5)
Sudan	8,866	7,510	6,606	(5)	(5)	(5)
Swaziland	1,246	983	1,080	(5)	(5)	(5)
Tanganyika	82,162	130,372	142,072	144,312	128,603	110,000
Uganda	20,502	15,115	11,060	9,505	9,900	(5)
Union of South Africa	12,161,392	12,821,507	14,096,502	14,407,649	[12] 14,120,617	[12] 12,800,021
	14,600,595	[6] 15,519,000	[6] 16,926,000	[6] 17,242,000	[6] 16,700,000	[6] 15,060,000
Oceania:						
Australia:						
Commonwealth [13]	1,592,035	1,645,697	1,643,999	1,496,698	1,153,787	750,000
Papua	29,834	36,118	20,845	14,000	(5)	(5)
New Guinea, Mandated Territory of	236,133	246,214	294,794	[6] 225,000	(5)	(5)
Fiji	92,362	110,000	111,338	118,681	99,667	90,000
New Zealand	152,050	178,955	195,665	[6] 190,000	[6] 170,000	[6] 150,000
	2,102,414	2,216,984	2,266,641	[6] 2,044,000	[6] 1,435,000	[6] 1,000,000
	[6] 37,876,000	[6] 39,904,000	[6] 42,044,000	[6] 40,766,000	[6] 35,519,000	[6] 29,659,000

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[1] Preliminary world gold-production table prepared with revisions and adjustments by B. B. Waldbauer and S. M. Anderson, Foreign Minerals Division, Bureau of Mines, in cooperation with the Office of the Director of the Mint. Figures used were derived in part from the Statistical Yearbook of the League of Nations and from the American Bureau of Metal Statistics. No official statistics are issued by Government of U. S. S. R., consequently figures released by the various authorities vary widely and are irreconcilable. In some countries accurate figures are not possible to obtain owing to clandestine trade in gold.

[2] Refinery production.

[3] Imports into United States.

[4] Exports.

[5] Data not available. Estimate included in total.

[6] Approximate production.

[7] Purchases by the State Central Bank.

[8] Conjectural figure published by the American Bureau of Metal Statistics (New York), Annual Issue.

[9] Beginning with 1939, Burmese production included with British India.

[10] Figure published by the Director of the Mint, representing gold of Philippine origin refined but not necessarily mined during the year.

[11] Beginning with 1941, production of Ruanda and Urundi included with Belgian Congo.

[12] Exclusive of nonmembers of the Transvaal Chamber of Mines.

[13] Includes New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, and Western Australia.

World production of silver, 1938–43, by countries, in fine ounces[1]

Country	1938	1939	1940	1941	1942	1943
North America:						
United States[2]	61,688,834	63,871,972	68,286,535	71,075,932	55,859,658	40,820,639
Canada	22,219,195	23,163,629	23,833,752	21,754,408	20,695,101	17,230,939
Central America and West Indies:						
Honduras	3,335,070	4,118,864	3,899,164	3,488,677	3,310,328	2,986,100
Other countries[3]	965,000	681,000	(4)	(4)	(4)	(4)
Mexico	81,018,809	75,870,575	82,640,074	78,363,961	84,864,616	86,453,345
Newfoundland	1,663,623	1,421,060	1,494,066	1,657,342	1,106,121	1,258,708
	170,891,000	169,127,000	180,754,000	176,941,000	166,436,000	149,350,000
South America:						
Argentina	2,419,504	2,840,518	1,926,081	1,575,000	2,066,907	(4)
Bolivia (exports)	6,373,660	7,241,312	5,626,380	7,348,695	8,121,438	7,299,730
Brazil	25,585	27,075	24,694	21,170	25,733	(4)
Chile	1,375,530	1,180,902	1,515,563	1,242,240	1,317,058	(4)
Colombia	192,880	242,628	260,310	271,115	246,281	209,950
Ecuador	89,111	103,331	105,000	116,836	261,945	(4)
Guiana, British	5,060	(4)	(4)	(4)	(4)	(4)
Peru	20,552,816	18,802,075	19,916,774	15,101,300	15,147,565	16,075,371
	31,034,000	30,443,000	29,380,000	25,681,000	27,192,000	(4)
Europe:						
Bulgaria (estimated)	13,000	(4)	(4)	(4)	(4)	(4)
Czechoslovakia	1,190,326	(4)	(4)	(4)	(4)	(4)
Finland	57,900	61,000	(4)	(4)	(4)	(4)
France	[3] 565,000	[3] 565,000	(4)	(4)	(4)	(4)
Germany	7,010,000	(4)	(4)	(4)	(4)	(4)
Austria						
Greece[3]	335,000	(4)	(4)	(4)	(4)	(4)
Hungary	46,632	51,600	(4)	(4)	(4)	(4)
Italy	812,481	880,000	(4)	(4)	(4)	(4)
Norway	250,776	295,787	(4)	(4)	(4)	(4)
Poland	62,244	(4)	(4)	(4)	(4)	(4)
Portugal	16,742	(4)	(4)	(4)	(4)	(4)
Rumania	819,876	712,731	500,204	(4)	23,970	(4)
Spain	237,658	306,493	1,050,365	455,319	143,714	734,902
Sweden	1,123,861	1,122,865	745,894	(4)	(4)	(4)
U. S. S. R.[3]	8,022,000	(4)	(4)	(4)	(4)	(4)
United Kingdom	107,985	70,818	81,496	59,669	47,082	33,885
Yugoslavia	2,524,123	2,293,634	(4)	(4)	(4)	(4)
	23,196,000	21,978,000	(4)	(4)	(4)	(4)
Asia:						
Burma	5,920,000	6,175,000	(4)	(4)	(4)	(4)
China	(4)	(4)	(4)	(4)	(4)	(4)
Chosen	(4)	(4)	(4)	(4)	(4)	(4)
Cyprus	[5] 199,719	[5] 103,953	58,341	(4)	(4)	(4)
Federated Malay States	3,500	(4)	(4)	(4)	(4)	(4)
Hong Kong	111,070	(4)	(4)	(4)	(4)	(4)
India, British	22,295	22,745	(4)	(4)	(4)	(4)
Indochina	2,411	1,672	1,736	(4)	(4)	(4)
Japan	[3] 10,100,000	(4)	(4)	(4)	(4)	(4)
Netherlands Indies	579,297	618,026	1,506,166	(4)	(4)	(4)
Philippine Islands	1,167,612	1,350,099	1,299,199	1,260,097	231,197	26,077
Sarawak	1,660	700	....	....	(4)	(4)
Taiwan	(4)	(4)	....	....	(4)	(4)
Turkey[6]	350,000	575,000	575,000	(4)	(4)	(4)
	21,623,000	23,115,000	22,868,000	(4)	(4)	(4)

See footnotes at end of table.

World production of silver, 1938–43, by countries, in fine ounces[1]—Continued

Country	1938	1939	1940	1941	1942	1943
Africa:						
Algeria	[6] 90,000	[6] 85,000	(4)	(4)	(4)	(4)
Bechuanaland	1,127	813	1,207	949	1,267	(4)
Belgian Congo	3,121,559	2,800,000	3,536,582	(4)	(4)	3,750,579
Gold Coast	23,000	(4)	(4)	(4)	(4)	(4)
Kenya Colony	11,200	[3] 12,000	13,626	(4)	(4)	(4)
Morocco, French	208,980	(4)	(4)	(4)	(4)	(4)
Nigeria	(4)	(4)	(4)	(4)	(4)	(4)
Portuguese East Africa	1,808	2,319	1,901	[3] 2,000	(4)	(4)
Rhodesia:						
Northern	88,237	80,137	312	45,697	40,000	(4)
Southern	166,417	173,556	186,080	170,364	163,776	119,322
Sierre Leone	1,271	(4)	(4)	(4)	(4)	(4)
South-West Africa	636,396	558,290	381,850	(4)	(4)	(4)
Tanganyika	16,621	28,004	36,737	40,143	(4)	(4)
Tunisia	61,149	(4)	(4)	(4)	(4)	(4)
Uganda	1,981	1,376	1,015	1,005	(4)	(4)
Union of South Africa	1,135,374	1,182,516	1,292,284	1,482,903	(4)	(4)
	5,615,000	5,361,000	(4)	(4)	(4)	(4)
Oceania:						
Australia:						
Commonwealth[7]	14,589,337	14,950,905	14,077,000	(4)	9,507,632	[3] 8,593,000
New Guinea, Mandate of	[6] 104,000	[6] 175,015	199,084	[6] 125,000	46,284	(4)
Fiji	12,380	(4)	23,020	[6] 30,382	28,911	(4)
New Zealand	357,709	390,342	415,330	[6] 400,000	300,000	(4)
	15,063,000	15,534,000	14,714,000	(4)	9,883,000	(4)
Total[8]	267,422,000	264,962,000	274,161,000	259,782,000	245,792,000	227,325,000

[1] Preliminary world silver production table prepared with revisions and adjustments by B. B. Waldbauer and J. R. Keighley, Foreign Minerals Division, Bureau of Mines, in cooperation with the Office of the Director of the Mint. No official statistics are issued by Government of U. S. S. R., consequently figures released by the various authorities vary widely and are irreconcilable.

[2] Philippine Islands excluded.

[3] Approximate production.

[4] Data not available. Estimate included in total.

[5] Exports.

[6] American Bureau of Metal Statistics (New York), Annual Issue.

[7] Includes New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, and West Australia.

[8] Imperial Institute (London), Statistical Summary.

REVIEW BY COUNTRIES

The following paragraphs include figures on the measured and indicated gold reserves of certain countries. These data have been compiled from several sources: Mining directories, company reports, numerous Government publications and mining journals, and information furnished by individuals familiar with certain deposits. For some countries or districts for which little or no information is available, estimates have been made by the Bureau of Mines based mainly upon production in recent years.

CANADA

Output of gold in Canada in 1943 dropped 25 percent below that in 1942 and nearly 32 percent below that in the record year 1941; silver declined 17 percent from the 1942 output. Production of gold from gold-bearing quartz fell, and that from base-metal ores rose, until by midyear base-metal ores were supplying nearly 17 percent of the gold compared with about 12 percent in 1942. Gold continued to be the most important mineral in Canada in point of value. Gold and silver production in 1943 was distributed among the various Provinces as follows:

Province:	*Gold, fine ounces*	*Silver, fine ounces*
Alberta	21	1
British Columbia	240, 530	9, 028, 912
Manitoba	92, 642	567, 141
Northwest Territories	59, 136	13, 134
Nova Scotia	3, 531	144
Ontario	2, 111, 807	2, 651, 777
Quebec	925, 120	2, 259, 442
Saskatchewan	174, 881	2, 657, 315
Yukon	42, 003	53, 073
Total	3, 649, 671	17, 230, 939

The labor situation was the greatest factor in causing reduced tonnages of gold ore, but contributing factors were Government regulations, heavy taxes, and difficulty in obtaining supplies. Employment fell from over 21,000 in January 1943 to about 16,000 in October 1943—a 24-percent decline. An influx of Indians to several camps gave some relief to the labor shortage, although many of the Indians never were able to advance beyond the mucking stage, and the language and income-tax problems presented considerable difficulty. In October the situation showed improvement as men released from war industries began drifting back to the gold mines. In the Kirkland Lake District about 100 families returned to the camps, and it was expected that the summer of 1944 would find labor much more plentiful.

Late in 1942 gold stocks on the Toronto exchange fell to a low figure when rumors were circulated that most gold mines might be closed; but by midsummer of 1943 gold shares established new highs owing chiefly to Allied military victories, proposals for new international monetary systems based on gold, as a hedge against possible inflation, and a general feeling that in the post-war period labor and materials would be plentiful, and gold mining would be very active again. Prospecting increased late in the year, and several promising gold prospects were uncovered to await the turn of events for extensive development. However, many Canadian miners felt that prospecting would be discouraged and capital would not be attracted to develop low-grade deposits until relief was had from the heavy taxes imposed on gold mines.

A survey of the measured and indicated gold reserves of Canada shows a total of about 34,000,000 ounces. It is estimated that 60 percent of this amount is in quartz veins, 5 percent in placers, and 35 percent in base-metal ores. The base-metal ore bodies of the International Nickel Co. of Canada, Ltd., the Noranda Mines, Ltd., and the Hudson Bay Mining & Smelting Co., Ltd., are estimated to contain nearly 11,000,000 ounces of gold. Most Canadian gold camps have been able to develop additional ore as needed, so it seems likely that given favorable conditions the gold industry will thrive many years beyond the period indicated by the present proved reserves.

CENTRAL AMERICA

Honduras.—Compañía Minera Agua Fria, S. A., suspended operations in May 1943 owing to its inability to get priorities on materials from the United States. The New York and Honduras Rosario Mining Co. was granted limited priorities, but several forced, temporary shut-downs interfered greatly with operations, and the quantity of ore milled was the lowest since 1938.

Nicaragua.—Gold mining in Nicaragua in 1943 was hampered by lack of replacement parts for machinery and by a shortage of supplies and miners. Nevertheless, production held up well, and gold exported dropped only 8 percent from that in 1942.

Central American gold reserves.—Much of Central America is difficult to prospect, hence the gold deposits may be very imperfectly known. Proved reserves probably do not total more than 2,500,000 ounces, of which at least half is in Nicaragua alone. Only gold lodes are known to contain appreciable reserves, although reports indicate that placers in Nicaragua may attain considerable importance in the future.

SOUTH AMERICA

Peru.—Output of gold in Peru in 1943 remained at a high level in spite of the unavailability of supplies from the United States. In July the Peruvian Government was notified that supplies and equipment would be furnished gold mines in areas of unemployment or serious economic dislocations.

In 1942 gold lodes and placers supplied about 70 percent of the gold output, and complex ores nearly 30 percent.

Venezuela.—Gold production in Venezuela in 1943 was barely more than half that in the record year 1940. New Goldfields of Venezuela, Ltd., further reduced its staff in September 1943 and was milling about 8,000 tons of ore per month.

Since 1928, lode mines have yielded more gold than placers. In the period 1934–40 lodes supplied an average of 79 percent of total gold output, and placers 21 percent.

South American gold reserves.—The measured and indicated gold reserves in South American countries are placed at about 17,000,000 ounces, of which 35 percent is estimated to be in Colombia, mostly in placers; nearly 25 percent in Peru, mostly in copper deposits; 20 percent in Brazil, mostly in gold lodes; 15 percent in Chile, and 5 percent in remaining countries. Many parts of South America, particularly in certain areas of pre-Cambrian rocks, appear very favorable for further discoveries of gold, and these should prolong appreciably the life of gold mining in those countries.

AFRICA

Union of South Africa.—In spite of shortages of labor and supplies, and increased costs of supplies, the Union succeeded in maintaining gold output in 1943 at a rate only 9 percent less than in 1942. However, lower returns resulted, and in the first half of the year most companies cut their dividend rates, a number passed dividends entirely, a few paid the same as in 1942, and only 1 increased its rate. New capital was difficult to raise, therefore plant expansion and development of new properties were reduced to a minimum. Even so, the future of the industry was viewed with optimism, and gold-mining shares were being bought more and more by the thrifty middle class of people.

The dependence of South African economy on gold mining was stressed in a recent article.[8] Studies tend to show that the economic well-being of the country is, at present, fundamentally bound up with the capacity of the gold mines to produce and distribute revenue, so that the industry directly or indirectly furnishes half of the population with a livelihood and the Government with half its revenues. Even manufacturing and agriculture are secondary industries and could not exist without the revenue produced by gold mining; and no primary industry is in prospect to take the place of the gold industry without serious economic and social dislocations. Prosperity has come to the Union when mining costs in terms of gold have fallen; depression, when they have risen. It is concluded that a policy is needed to insure the industry a long and stable life and that nothing should be allowed to cause the pay limit (the minimum amount of gold contained in a ton of ore which can be mined without monetary loss) of existing or potential gold mines to rise unless it is absolutely unavoidable.

Proved gold reserves in South Africa are the largest of any country on the globe and are placed at not less than 240,000,000 tons of gold ore containing some 57,000,000 ounces of gold. Geologic conditions make it certain that many more millions of tons of ore will be developed as needed, particularly if political and economic factors remain favorable, and if steps are taken to facilitate mining at greater depths than has been practicable heretofore.

Southern Rhodesia.—The proved gold reserves of Southern Rhodesia are placed at not less than 4,000,000 ounces. Some of the larger deposits are those of the Cam & Motor Gold Mining Co., Ltd., Wanderer Consolidated Gold Mines, Ltd., and Bushtick Mines, Ltd.

Gold Coast.—Proved gold reserves of this country are believed to total nearly 9,000,000 ounces, about 80 percent of which is in gold lodes. The remaining 20 percent is largely in the placer deposits of the Gold Coast Selection Trust Co. and the Bremang Gold Dredging Co., Ltd.

Other countries.—Reserves of some 7,000,000 ounces of gold, enough to bring the total for Africa to more than 77,000,000 ounces, are known in other African countries, mainly in Belgian Congo and Tanganyika.

EURASIA

Measured and indicated gold reserves of Eurasia are estimated at 50,000,000 ounces, and it is believed that nearly half of this is in Russia alone. At the time of Pearl Harbor the proved reserves of the Philippine Islands totaled about 3,500,000 ounces. Other reserves of importance are in India, Chosen, Japan, Manchuria, Taiwan, Rumania, and Sweden. So little is known of the gold deposits in some parts of Asia that it is impossible to predict the future for many areas.

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[8] South African Mining and Engineering Journal, Importance of the Gold Mining Industry to South Africa: Vol. 54, August 28, 1943, pp. 549–555.

OCEANIA

Australia.—The Australian gold-mining industry fared badly in 1943, mainly because of shortages of labor, equipment, and supplies, and output declined 35 percent from 1942. Many important producers closed, among them the Big Bell mine in Western Australia, and others were reduced to a maintenance basis. The result was a pronounced depopulation of inland centers and serious economic dislocations, especially in Western Australia, where great dependence is placed on gold mining.

The proved gold reserves of Australia are estimated at about 11,000,000 ounces, nearly 65 percent of which appears to be in Western Australia. The more important reserves are those held by the Mount Morgan, Ltd., in Queensland, and the Lake View & Star, Ltd., and the Big Bell Mines, Ltd., in Western Australia. Gold ores contain all but a small part of the reserves; placers and base-metal ores are of minor importance.

Other Oceanic countries.—Many gold properties in other Oceanic countries were closed or were operated on a restricted basis in 1943 because of war conditions. The more important deposits are in New Guinea and New Zealand, which together have proved reserves estimated at nearly 4,000,000 ounces. All but a small part of this quantity is in placer deposits, the largest of which is that of the Bulolo Gold Dredging, Ltd., in New Guinea, stated to contain over 1,500,000 ounces of gold. The known combined reserves of Fiji and Tasmania probably total less than 1,000,000 ounces.

COPPER

By T. H. Miller and H. M. Meyer

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GENERAL SUMMARY

In 1943 copper withdrew from its position as probably the outstanding critical metal, and this change crowns with success the efforts of Government, industry, and labor to bring supplies and essential requirements into virtual balance. In January 1944 it was reduced from group I to group II on the eleventh Material Substitutions and Supply List of the Conservation Division, War Production Board. Group I comprises materials the supply of which is insufficient for essential needs and group II those in approximate balance. Copper had been in group I since the first list was issued in March 1942.

The accomplishment of the main objective, however, left little metal available for easing the limitations on consumption for other than war and the most essential civilian purposes.

The chapter on Copper in Minerals Yearbook, 1942, outlined the steps taken by the Government to achieve adequate supplies of copper for war purposes and to hold consumption to a necessary minimum. On the whole, the 1942 program was continued in 1943; and, particularly in the early part of the year, additional restrictive measures were invoked. For the most part, however, the peak of Government action, both of an encouraging and of a restrictive nature, had passed.

Production from domestic mines gained 1 percent over the previous peak in 1943. Monthly mine figures (which have not been adjusted to the annual final total) show that 270,000 tons were produced in the first quarter, 275,000 in the second, 266,000 in the third, and 277,000 in the fourth. The larger outputs at some going mines, such as Morenci and Utah Copper, and new production from those such as the Castle Dome (Arizona) were able to little more than offset declines caused by labor deficiencies. Imports of 402,762 tons of refined metal were slightly above the previous peak of 401,436 tons in 1942. Production in the United States of refined copper from foreign crude materials declined 15 percent in 1943 or to 297,184 tons from 349,769. Deliveries of copper, by producers to customers, which include some metal from scrap aggregated 1,643,677 tons in 1943 so were little changed from the former high record of 1,635,236 tons for 1942. Deliveries by quarters were 415,000, 427,000, 418,000, and 384,000 tons, respectively. Deliveries in the final quarter were 9 percent below the average for the previous three and in December were 17 percent below the average for the preceding 11 months.

The figures presented in the foregoing paragraph led to some belief that the copper position at the end of 1943 had improved sufficiently to make increased civilian consumption possible. The rising stocks of the Metals Reserve Co. at the end of 1943 were viewed by certain persons with concern, and suggestions were advanced that more generous allotments be made for civilian needs.

The easier situation in the last quarter of the year was due in large part to the cut-backs in the small-arms-ammunition program, in connection with which the Army Ordnance Department announced that the Army has enough ammunition "for any crises however unexpected." A statement released by the Office of Civilian Requirements in mid-November was that copper would "definitely be available in fair quantities" for civilian purposes in the near future. In November, too, the War Production Board announced that special copper premium prices, under the plan in effect since May 1, 1943, would not be paid on applications postmarked after December 31. Another outgrowth of the easier situation was the reduction in the work week at certain properties.

Salient statistics of the copper industry in the United States, 1925–29 (average) and 1940–43, in short tons

	Average (1925–29)	1940	1941	1942	1943
New copper produced—					
From domestic ores, as reported by—					
Mines	885, 826	878, 086	958, 149	1, 080, 061	1, 090, 818
Ore produced:					
Copper ore	59, 505, 871	[1] 69,278,476	[1] 78,452,504	[1] 92,285,626	(2)
Average yield of copper, percent	1. 44	1. 20	1. 15	1. 09	(2)
Smelters	892, 730	909, 084	966, 072	1, 087, 991	1, 092, 939
Percent of world total	51	(2)	(2)	(2)	(2)
Refineries	890, 767	927, 239	975, 408	1, 064, 792	1, 082, 079
From foreign ores, matte, etc., refinery reports	317, 287	386, 317	419, 901	349, 769	297, 184
Total new refined, domestic and foreign	1, 208, 054	1, 313, 556	1, 395, 309	1, 414, 561	1, 379, 263
Secondary copper recovered from old scrap only	347, 512	333, 890	412, 699	427, 122	427, 521
Copper content of copper sulfate produced by refiners	4, 601	5, 643	6, 984	8, 076	7. 667
Total production, new and old and domestic and foreign	1, 560, 167	1, 653, 089	1, 814, 992	1, 849, 759	1, 814, 451
Imports (unmanufactured) [3]	391, 212	491, 342	735, 545	764, 393	712, 847
Refined [3]	59, 236	68, 337	346, 994	401, 436	402, 762
Exports of metallic copper [4]	522, 616	427, 650	158, 893	210, 518	294, 497
Refined (ingots, bars, rods, etc.)	482, 868	377, 108	114, 753	131, 732	177, 341
Stocks at end of year	307, 200	334, 500	317, 500	319, 500	309, 500
Refined copper	86, 100	91, 500	77, 500	84, 000	68, 500
Blister and materials in solution	221, 100	243, 000	240, 000	235, 500	241, 000
Withdrawals from total supply on domestic account:					
Total new copper	778, 123	1, 008, 785	1, 641, 550	[5] 1, 678, 091	1, 621, 666
Total new and old copper	1, 288, 700	1, 541, 000	2, 368, 000	[5] 2, 606, 000	2, 708, 000
Price, average ... cents per pound	14. 7	11. 3	11. 8	[6] 11. 8	[6] 11. 8
World smelter production, new copper	1, 761, 000	(2)	(2)	(2)	(2)

[1] Includes old tailings.
[2] Figures not yet available.
[3] Data include copper imported for immediate consumption plus material entering country under bond.
[4] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper. Exclusive also of "Other manufactures of copper," for which figures of quantity are not recorded.
[5] Revised due to foreign trade changes.
[6] Exclusive of bonus payments of the Metals Reserve Co.

The improved outlook was not confined to the United States. A report of the Combined Raw Materials Board and the Combined Production and Resources Board stated in September that the new supply of copper and its present actual consumption by the United Nations had reached a rough balance. Shipments of copper from Africa to the United Kingdom, it appears, had been speeded by the resumption of Mediterranean routes. The Board emphasized that the balance depended on maintaining existing and projected production rates of new copper, the collection of scrap, and the acceptance of steel cartridge cases. Rumors early in January 1944 hinted that Rhodesian copper production would be cut 20 to 25 percent.

Early in December 1943, however, Charles E. Wilson, Executive Vice Chairman of the War Production Board, announced a sharp expansion in the general over-all production program for 1944. Certain types of production would be curtailed, he said, but the over-all total called for was 80 percent above the 1942 rate. According to Wilson, the production of small arms ammunition in 1943 would be 142 percent above 1942, but the projected rate for 1944 will be only 60 percent of current production. With respect to artillery ammunition a reverse trend is indicated. Output in 1943 would be 70 percent greater than in 1942, the current rate being 120 percent over 1942, and 1944 requirements called for an average production 25 percent higher than the present rate. Aircraft production in 1944 was expected to be 235 percent higher than the 1942 rate, the merchant ship program 145 percent above 1942, and the schedule for big trucks is twice the 1942 rate. On the other hand, a slight falling off from current rates in ship construction for the Navy was expected, production of ordnance and signal equipment for the ground army was not expected to increase, and the tank program would be 25 percent below 1942. All those items are large users of copper, so upon the basis of the foregoing predictions copper consumption would surely gain in 1944.

Michael Schwarz, who succeeded H. O. King as Director of the Copper Division of the War Production Board, warned early in 1944 that requirements were barely balanced by the supply, based upon maximum and uninterrupted production in the mines, in the refineries, and in the brass and wire mills. He appealed to industry and labor for their utmost contribution to current requirements and said that "If workers leave their jobs during the summer months as they did in the past 2 years there will be a serious crisis." The Board estimated that requirements in 1944 would be 3,378,000 tons compared with supplies from all sources of 3,385,000 tons, obviously providing scant margin for any noteworthy defection in supplies.

That the more pessimistic attitude was justified is borne out by the increased tempo of deliveries by producers after February 1944 and the establishment of a new peak record for May; in the 3 months ended in May the total was higher than for any similar previous period.

In the last months of 1943 and early in 1944 there was a tendency to withdraw some of the restrictions on the use of copper and copper alloys. On the whole, the relaxations affected only highly essential civilian goods where the use of copper provided a saving in manpower or where the use of substitute materials had proved impractical. Permission to coin the familiar copper pennies again, beginning January 1, 1944, responded to overwhelming popular demand. In no case are the relaxations believed to have involved substantial tonnages.

The rumored drop in Rhodesian copper output did not eventuate and the surplus over British Empire needs was reported to be scheduled to come to the United States.

The program for substituting steel for brass in cartridge-case manufacture on the substantial scale mentioned in Minerals Yearbook, 1942, was largely abandoned at the end of 1943 after brass-production capacity had been materially increased. The demand for enormous tonnages of ammunition for immediate training purposes and for future combat reached a peak simultaneously with the most critical stage in supplies of brass. With respect to relieving the pressure on brass supplies at the time and providing adequate ammunition for training purposes, the substitution of steel may be considered to have been successful. It is significant however, that the Army returned to the use of brass at the earliest possible moment. Steel would not have been used if adequate supplies of brass had been available, and on the whole the quantity of steel cases used in actual combat was small. The constant temperature and moisture conditions surrounding the handling of ammunition by the Navy make its use of steel cartridge cases more practical than for the Army, which has to cope with continuous changes. Production of steel cases is being continued by the Army on a limited scale for test purposes and for further development of the art.

The unbalanced relationship between brass casting and rolling capacity in 1943 was solved in part when the Weirton Steel Co. began to roll brass in its steel mill at Weirton, W. Va. Its capacity for rolling brass was said to place it among the leaders in this industry.

The ban on publication of many statistics was lifted at the end of the year, and figures on copper production, shipments, and other items were released. The progress in war production had been such that the data would aid the enemy little, if at all, and surely would not comfort him. It was still inadvisable to publish foreign trade data, and information on Government stocks also continued to be withheld.

Although details covering many countries cannot be obtained, available data indicate that world copper production was virtually the same in 1942 and in 1943 at probably slightly above 3,000,000 short tons. Of the principal producing countries, the United States and Chile had new record mine outputs that—with gains by some smaller producers—offset the declines reported by other large producers. Labor and equipment shortages were the main causes of the decreases noted, although a severe drought was the chief deterrent in Belgian Congo. The production records for the United States and Chile were made despite similar problems.

The increased production capacity at Morenci and Bagdad, the opening of the new mill at Castle Dome, Ariz., new production at the Gray Eagle property, Calif., the new tailings plant at the Quincy mine, Mich., the new projects of the Ohio Copper Co. (the Big Indian, Utah) and the Vermont Copper Co. in Vermont, and other factors that were aimed at larger production are described in the various chapters on gold, silver, copper, lead, and zinc in the different States.

LABOR CONDITIONS

The labor shortages, discussed in the chapter on Copper in Minerals Yearbook, 1942, continued to plague operators of mines, mills, smelters refineries, and fabricating plants in 1943. The Army was called upon in 1942 to stem the downtrend in employment; 4,300 men were released, and 2,300 were allocated to copper mines. The continued critical labor situation led to another "draft" on the Army in 1943, and 4,500 men were released in August and September, of whom 3,200 went to copper mines. As of January 1, 1944, employment in copper mines was reported [1] to be 32,927 men and current labor needs to be 2,717. Reducing turn-over and replacing workers who leave in 1944 were expected to be difficult to accomplish. Labor needs in the 19 principal smelters that employ 20,800 workers were about 1,200 in January 1944. Of this number, 600 were required to allow all departments to operate with normal efficiency, and the additional 600 workers would permit capacity operations. The Commission's report stated that, in addition to these needs, heavy replacements must be made. The nature of the work precludes the use of women, even if they could be recruited.

In authorizing the release of 4,500 men from the Army in July 1943 to accept jobs in the copper, zinc, and molybdenum mines, Acting Secretary of War Patterson said that earlier efforts to recruit additional miners from civilian sources in required numbers had failed and that the success of the 1943-44 military program, as a consequence, "is jeopardized by a growing shortage of these vital metals." The men were to be allocated only for work "in mines of highest productivity located in areas of critical labor shortage. Mines in which the yield of metal per man is relatively small will not be permitted to hire the soldiers who are to be released."

The three predominant copper-producing companies in the United States and in the world—the Anaconda Copper Mining Co., Kennecott Copper Corporation, and Phelps Dodge Corporation—all complained of critical labor shortages in 1943. The furloughing of soldiers by the Army for work in mines eased the problem but did not furnish its solution. Anaconda said that a Miner's Training Program, which prepared inexperienced men for work underground, helped to relieve its situation. Kennecott stated that the corporation plants are located in districts designated by the War Manpower Commission as "vital manpower areas" but that nevertheless difficulty was experienced throughout the year in securing sufficient employees to operate on maximum-capacity schedules. There was no reduction in the tonnage of ore mined by shovels in open-pit operations; but the underground mines, where the labor shortage was felt most severely, reported a substantial decrease in mine output. Phelps Dodge operated all of its branches at capacity "within the limits imposed at times by manpower." According to the American Smelting & Refining Co., because of the shortage of labor some plants were unable at times to operate at much more than 50 to 60 percent of capacity.

A report by Dingman [2] on the training of miners was prepared for the Bureau of Training, War Manpower Commission, and an abstract was published.

STOCK-PILE LEGISLATION

Following World War I the copper industry slumped during the period of universal depression; because the properties of copper make it particularly desirable for many war uses, probably this industry was affected more adversely than most. The chapter on Copper in Mineral Resources 1921 said:

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[1] War Manpower Commission, Confidential Report on Production and Manpower Situation in Metals and Minerals Industries, March 13, 1944.

[2] Dingman, Oscar A., Training Miners for Greater Copper Production: Min. Cong Jour., vol. 29, No. 6, June 1943, pp. 20-27.

> * * * The production, though greatly reduced as compared with that of the preceding 4 years, largely exceeded the withdrawals, and the year 1921 began with the smallest consumptive capacity in about 15 years, the greatest stocks in the history of the industry, and a selling price of nearly 2 cents a pounds less than the weighted average cost of production for the year 1920, exclusive of depletion. If depletion charges are taken into account, the selling price on January 2, 1921, was above 5 cents less than the weighted average cost of production in 1920. Under such conditions it was inevitable that production should practically cease until the enormous stocks were absorbed, the cost of production lowered, and the selling price increased sufficiently to permit operation without loss. Accordingly, by April 1, 1921, nearly all the large companies had discontinued operations. The extent of the shutdown can best be realized by a comparison of the smelter production in 1921 with that of previous years. It was followed by an investigation of the industry by the Department of Justice on account of suspected violation of the Sherman Act. It was obvious, however, that continuation of mining under the prevailing conditions could only lead to bankruptcy for many companies and the useless exhaustion of a wasting asset of great national importance at the cost of mining or less for the industry as a whole.

Legislators, industry as a whole, and labor desire to prevent a recurrence of the mining conditions of the period following the First World War. The armament requirements of the second world conflict are such that the possibilities of the present situation far overshadow those that attended the first. A stock-pile bill (S.1160) was introduced in Congress by Senator Scrugham of Nevada on June 3, 1943. Representatives of Government, industry, and others presented their views before the committee; they were generally in favor of the theory of stock-piling, although they disagreed in part with some of the features of the bill. Opinions of Harold L. Ickes, Secretary of the Interior, Howard J. Trueblood, Office of Advisor on International Economic Affairs of the Department of State, Julian D. Conover, Secretary of the American Mining Congress, and others were published in Metals.[3] R. R. Eckert, Secretary of the United States Copper Association, voiced the sentiment of the copper industry in favor of stock-piling metals after the war. He suggested an eight-point program, as follows: .

1. The United States should retain possession of all copper owned or controlled by it, in whatever form, including ore, concentrates, materials in process of smelting, refining, or fabricating, copper in commercial form and all scrap copper such as exploded shells, copper wire from the demolition of buildings and the scrapping of worn-out tanks, jeeps, etc.
2. The Government should fulfill all copper purchase contracts in whatever form in existence at the termination of the present emergency.
3. The Government should acquire all surplus stocks of copper owned by producers and fabricators on hand at the end of the war, in excess of normal working stocks and quantities required for commercial use.
4. For a transition period of not less than 6 months and perhaps not more than 1 year following the cessation of hostilities, the Government should acquire all copper produced by mines of the United States in excess of the tonnage required for commercial use.
5. For the same period of 6 months to 1 year, the Government should acquire the copper produced by Latin American mines in excess of the tonnage marketed in foreign countries.
6. For a period of 18 months following the cessation of hostilities, the Government should acquire, or retain if already owned, all scrap copper, in whatever form, as may be offered for sale within territorial United States, if in the opinion of Army or Navy officials, such scrap resulted from hostilities in the present war with Germany, Italy, or Japan.

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[3] Metals, vol. 14, No. 3, September 1943.

7. All ore, concentrates, scrap, and material in process at smelters and refineries should be processed to refined copper. All finished goods at fabricating or munitions plants or arsenals should be retained by the Government, if, in the opinion of Army or Navy officials, they are suitable for present equipment. All goods in process of fabrication, depending upon its character and the degree of processing already completed, should (*a*) be finished and stored in arsenals or (*b*) returned to the refineries and processed to refined copper, as directed by Army and Navy officials.

8. All copper so owned or acquired by the Government should be placed solely under the control of the Secretary of War and the Secretary of the Navy for storage and stock-piling at such strategic points or places as they may direct and should be held intact for a war emergency.

S.1160 was revised and reintroduced on December 8, 1943, as S.1582.

INVESTIGATIONS OF THE GEOLOGICAL SURVEY AND THE BUREAU OF MINES

The Geological Survey program of investigations of copper resources was continued actively throughout 1943. As in the preceding year, some studies were made of inactive minor districts offering possibilities for production, but attention was directed increasingly toward problems of ore supply in producing districts. Several studies were conducted in conjunction with exploration projects of the Bureau of Mines, and numerous individual copper deposits were examined during the year at the request of other Government agencies. The Geological Survey investigations included copper deposits in Alaska and Mexico, as well as in the continental United States.

During 1943 geologic investigations in the United States were undertaken in Vermont, New Jersey, the Southeastern States, Michigan, the Colorado Plateau, New Mexico, Montana, Washington, Idaho, the foothill region in California, and the Castle Dome, Bagdad, and Christmas mines and the Old Hat and Helvetia districts in Arizona.

Preliminary geologic maps of the North Keystone mine, California, the Elizabeth mine area, Vermont, and the Steeple Rock district, New Mexico, were released for public distribution. Preliminary reports on studies of the White Mesa and Old Hat districts, Arizona, the Organ district, New Mexico, the Elizabeth mine, Vermont, and the Hazel Creek mine, North Carolina, were placed in the open files.

In Alaska during 1943 the Geological Survey continued its investigation of the iron-copper deposits on the west side of Kasaan Peninsula and the Salt Chuck copper-palladium mine (Prince of Wales Island). A magnetometer survey was made of a part of a nickel-copper deposit at Bohemia Basin (Yakobi Island). The Rua Cove copper deposit in the Prince William Sound region was examined, as were copper deposits in the Kotsina-Kuskulana district and the Nizina district. Moreover, information regarding most of the old mining areas in the Prince William Sound region was collected.

The Geological Survey also investigated in 1943 several copper deposits in Mexico under the auspices of the United States Department of State.

During the calendar year 1943 the Bureau of Mines operated 26 copper-exploration projects in 13 States; 10 of these operations were carried over from the previous year.

These properties and their locations follow: Stone Hill mine, Cleburne and Randolph Counties, Ala.; Twin Buttes and Control mines, Pima County, San Manuel and Old Reliable mines, Pinal

County, Christmas mine, Gila County, and Zonia mine, Yavapai County, Ariz.; West Belt area, Calaveras and Amador Counties, and Blue Ledge mine, Siskiyou County, Calif.; Colorado Copper Co. mine, Montrose County, Colo.; Empire mine, Custer County, and the Uncle Sam mine, Blackbird district, Lemhi County, Idaho; Hidden Treasure mine, Clinton County, Shamrock mine, Jefferson County, and Green Mountain mine, Sanders County, Mont.; Majuba Hill mine, Pershing County, Nev.; Guadalupe (Stauber) mine, Guadalupe County, Lordsburg district, Hidalgo County, and Red River (Copper King) mine, Taos County, N. Mex.; Ore Knob mine, Ashe County, Union mine, Cabarrus and Rowan Counties, and Durgy mine, et al., Virgilina district, Person and Granville Counties, N. C.; Boston Consolidated mine, Salt Lake County, Utah; Elizabeth mine and vicinity, Orange County, Vt.; Toncrae-Howard mine, Floyd County, Va.; and Rambler mine, Albany County, Wyo.

Exploration by the Bureau on these properties and areas comprised 77,085 feet of drilling, 9,118 feet of trenching, and 1,044 feet of underground drifting. This development indicated approximately 2,000,000 tons of ore containing about 31,500 tons of copper. In addition, 460,000 tons of material containing 6,000 tons of copper were indicated but it cannot be mined under present conditions. Several hundred properties were examined on which no work was done by the Bureau.

Diamond drilling, which was started in 1942 in the Christmas mine, Arizona, was carried on throughout 1943. A substantial tonnage of ore was developed by this exploration, so that mining operations may be continued there for several years because of this augmentation of the nearly depleted ore reserves.

Exploration by the Bureau at the Elizabeth mine, Vermont, was continued from 1942 and completed. Mining and milling resulted in production in October 1943. Geophysical work and diamond drilling were carried on during the summer on the Eureka-Union and the Diamond properties near the Elizabeth.

The project on the Uncle Sam mine, Idaho, started in August 1942, was recessed in March 1943 and resumed in August. Diamond drilling has developed a large tonnage of copper-cobalt ore in a deposit west of the Uncle Sam mine in which 75,000 tons of similar ore were developed last year.

Samples of all the copper ores discovered by these explorations were assayed in several Bureau of Mines laboratories. Ore-dressing tests also were carried out on most of these ores by means of grinding, flotation, log washing, jigging, leaching, and tabling to determine the best method of milling treatment. Considerable research was done on alloys of copper with manganese, nickel, zinc, beryllium, and other metals; the results have contributed largely to the knowledge and application of copper alloys.

POST-WAR OUTLOOK

Throughout the years the consumption of copper has been an index to general industrial activity; it would appear safe to assume, therefore, that in the post-war period the demand for copper will be proportionate to the rate of industrial prosperity. This assumption is not entirely safe, according to some authorities, because of expansion in the use of light metals during the war period, their substitution for copper and its alloys in many uses, and the competitive threat they promise for post-war markets. The consensus, however, seems to be that consumption of copper will be high after the war, dependent, of course, on the expected era of prosperity that should follow the conversion of industry in general to peacetime pursuits, the filling of pent-up civilian needs, and rehabilitation activity in many parts of the world. In the first half of 1944, Arthur D. Whiteside, president of Dun & Bradstreet and previously Vice-Chairman for Civilian Requirements of the War Production Board, commented that despite the many uncertainties it will face at the end of the war, business will enjoy 3 to 5 of the most prosperous years it has ever had. The question then would seem to be: How much of its normal market can copper reclaim? The general belief is that most consumers will return to the use of copper after the war because of its greater efficiency, because of industrial habit, or both. Price, as always, will be a determining influence. Even should aluminum have a favorable competitive position pricewise after the war, it would still be unlikely to compete where size is a factor. Copper will undoubtedly continue to be in demand for the many thousands of motors, and telephone and other electrical equipment of all kinds that will be required by a strong post-war market. Electrical equipment of all kinds took about half of the pre-war copper consumed. Building, exclusive of electrical apparatus, took 89,000 tons of copper in 1939, according to the American Bureau of Metal Statistics. According to the F. W. Dodge Corporation the total construction volume in the 10 years following the war will average approximately double the average annual volume of the 1930–39 decade, which was a period of depression and slow recovery. Automobiles (other than for starter, generator, and ignition equipment) took 85,000 tons of copper in 1939. Trade estimates indicate that automobile manufacture after the war will average 50 percent over the pre-war rate, at least until the cumulative demand—estimated at 10,000,000 cars—has been satisfied. On the whole, copper consumption in the post-war period is expected to be well above that in pre-war times, perhaps for several years or until the back-log of civilian demands has been filled. On the other hand, it will certainly not equal war requirements for new copper, which in 1941–43 averaged substantially more than double the average quantities used in the period of industrial prosperity of the late twenties (1925–29).

As pointed out in the Engineering and Mining Journal,[4] the transition from war to peace will be more complex for copper than for commodities less intimately associated with the war.

Sullivan[5] suggests that a more important problem than the substitution of aluminum and magnesium for copper after the war is "In the next quarter century, where are we going to get enough copper to meet the demands?"

Two political factors will have a sharp bearing on the post-war demand for newly-mined copper: First, the Government attitude toward stock-piling copper on hand at the end of the war in the forms of (1) refined metal, (2) intermediate war materials, and (3) scrap returned from battlefields and scrap from obsolete equipment of all kinds; and second, the Government attitude toward permitting entry into the country of foreign crude, refined, and fabricated copper.

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[4] Engineering and Mining Journal, Major Nonferrous Metals—Copper: Vol. 145, No. 2, February 1944, p. 77.

[5] Sullivan, John D., Role of the Heavy Metals in the Postwar Economy: Min. Cong. Jour., vol. 30, No. 3, March 1944, pp. 29–34; and other magazines.

DOMESTIC PRODUCTION

Statistics on copper production may be compiled upon a mine, smelter, or refinery basis. Mine data are most accurate for showing the geographic distribution of production; smelter figures are better for showing the actual recovery of metal and fairly accurate for showing the source of production; and refinery statistics give precise information regarding metal recovery but indicate only in a general way the source of crude materials treated. The chapter on Copper in Mineral Resources of United States, 1930, part 1, discusses the differences among the three sets of figures.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1939–43, in short tons

Year	Mine	Smelter	Refinery
1939	728, 320	712, 675	704, 873
1940	878, 086	909, 084	927, 239
1941	958, 149	966, 072	975, 408
1942	1, 080, 061	1, 087, 991	1, 064, 792
1943	1, 090, 818	1, 092, 939	1, 082, 079

PRIMARY COPPER

Smelter production.—The recovery of copper by smelters in the United States from ores of domestic origin totaled 1,092,939 short tons in 1943, or less than 0.5 percent above the total of 1,087,991 tons for 1942. Domestic smelter output constituted 51 percent of the world production during 1925–29 but dropped sharply in the succeeding years until 1934, when it was only 17 percent. From 1936 to 1940 it fluctuated between 25 and 32 percent, and in 1942–43 it is believed to have been nearly 35 percent.

The figures for smelter production are based upon confidential returns from all smelters handling copper-bearing materials produced in the United States. For Michigan the sum of furnace-refined copper and copper cast into anodes for electrolytic refining is included. The figures for blister represent the fine-copper content. Some casting and electrolytic copper produced direct from ore or matte is included in the smelter production. Metallic and cement copper recovered by leaching is included in smelter production.

The precise quantity, in pounds, of copper produced by smelters in the United States and its value are shown by years for 1845–1930 in the Copper chapter of Mineral Resources of the United States, 1930, part 1.

Copper produced in the United States from domestic ores, 1939–43, by States

[Smelter output, in short tons fine]

State	1939	1940	1941	1942	1943
Alaska	152	64	95	33	31
Arizona	262, 706	287, 267	328, 550	388, 394	397, 434
California	4, 246	6, 546	4, 015	1, 019	8, 522
Colorado	12, 774	13, 186	6, 483	1, 249	1, 134
Georgia		13			
Idaho	2, 316	3, 690	3, 551	3, 889	2, 330
Michigan	44, 701	45, 743	46, 752	47, 470	45, 498
Missouri	510	819	773	2, 658	1, 736
Montana	101, 756	129, 071	128, 712	140, 465	138, 295
Nevada	64, 422	78, 621	80, 518	83, 434	71, 553
New Mexico	37, 042	70, 484	73, 848	79, 598	78, 804
North Carolina	(1)	(1)	(1)	(1)	(1)
Oregon	48	101	84	113	9
Pennsylvania	(1)	(1)	(1)	(1)	(1)
South Carolina	(2)			1	1
South Dakota		6			1
Tennessee	(1)	(1)	(1)	(1)	(1)
Texas	33	33	7	104	84
Utah	163, 059	248, 732	270, 647	317, 717	325, 961
Vermont					100
Virginia	(2)				51
Washington	8, 378	10, 511	8, 667	8, 525	7, 407
Wyoming		2	4	1	1
Undistributed	10, 532	14, 195	13, 366	13, 321	13, 987
	712, 675	909, 084	966, 072	1, 087, 991	1, 092, 939

[1] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[2] Less than 1 ton.

Copper produced (smelter output) in the United States, 1939–43, and total, 1845–1943

[Values rounded]

Year	Short tons	Value
1939	712, 675	$148, 236, 000
1940	909, 084	205, 453, 000
1941	966, 072	227, 993, 000
1942	1, 087, 991	[1] 256, 766, 000
1943	1, 092, 939	[1] 257, 934, 000
Total, 1845–1943	30, 645, 480	8, 994, 713, 000

[1] Excludes bonus payments of Metals Reserve Co.

Mine production.—The figures for mine production are based upon reports supplied to the Bureau of Mines by all domestic mines that produce copper. Details of the method of collecting the statistics and reasons for the discrepancy between mine-, smelter-, and refinery-production figures are given in the Copper chapter of Mineral Resources of the United States, 1930, part 1.

Mine production is more accurate than either refinery or smelter production for showing the distribution of domestic output by States and districts. It also indicates the production by calendar years more exactly, because additional time is required for smelting and refining. Mine production in 1943 was 1,090,818 tons—an increase of 1 percent over that in 1942 and 23 percent above the average for 1925–29.

Production by States and districts.—The following tables show mine and smelter production, by States, for 1942 and 1943 and mine output, by districts, for 1939–43. In 1943 Arizona, Utah, and Montana led in production, with 79 percent of the smelter total compared with 78 percent in 1942; adding the output of New Mexico, Nevada, and Michigan to the foregoing brings the proportion to 97 percent of the total for the country, unchanged from 1942. Arizona produced 36 percent of the total, Utah, 30, and Montana 13. The Arizona and Montana percentages are unchanged from 1942, but that for Utah continued the uptrend of recent years, advancing 1 percent. Montana's tonnage dropped in 1943. The three other States specified (New Mexico, Nevada, and Michigan) represented smaller proportions of the United States total in 1943 than in 1942, as in 1942 they were smaller proportionately than in 1941; all showed tonnage declines also in 1943. On the whole, other States produced less copper in 1943 than in 1942 with the noteworthy exception of California, whose sharp gain was due chiefly to the entry into the ranks of producers of the Gray Eagle Copper Co., operating the Dakin mine, Klamath River district, Siskiyou County. It became by far the largest producer in California. The Keystone mine, Copperopolis district, Calaveras County, increased its output substantially in 1943, also contributing to California's increase. Comparison of present production with that of the past century focuses attention on the rapidly rising production of Utah; this State contributed 30 percent of the total in 1943 compared with 14 percent in the period 1845–1943. Arizona, the principal producing State, continues to supply more than its average for the past century. Michigan and Montana, on the other hand, show sharp defections from their earlier rates. Proportionately, output in New Mexico in 1943 was almost double that for 1845–1943 and that in Nevada was also higher, but the rise was more modest.

Copper produced in the United States according to smelter and mine returns, by States, 1942–43 and 1845–1943, in short tons

State	1942		1943			1845-1943 smelter output	
	Smelter returns	Mine returns	Smelter returns		Mine returns	Total quantity	Percent of total
			Percent of total	Quantity			
Alaska	33	22	(1)	31	27	676,847	2.21
Arizona	388,394	393,387	36.37	397,434	403,181	10,200,316	33.28
California	1,019	1,058	.78	8,522	8,762	584,009	1.90
Colorado	1,249	1,102	.10	1,134	1,028	273,898	.89
Georgia	-----	-----	-----	-----	-----	(2)	(2)
Idaho	3,889	3,430	.21	2,330	2,324	97,710	.32
Michigan	47,470	45,679	4.16	45,498	46,764	4,730,353	15.44
Missouri	2,658	1,300	.16	1,736	1,340	(2)	(2)
Montana	140,465	141,194	12.65	138,295	134,525	6,361,517	20.76
Nevada	83,434	83,663	6.55	71,553	71,068	1,608,464	5.25
New Mexico	79,598	80,100	7.21	78,804	76,163	1,168,705	3.81
North Carolina	(3)	(3)	(3)	(3)	(3)	(2)	(2)
Oregon	113	103	(1)	9	6	11,657	.04
Pennsylvania	(3)	(3)	(3)	(3)	(3)	(2)	(2)
South Carolina	1	(4)	(1)	1	(4)	(2)	(2)
South Dakota	-----	1	(4)	1	-----	(2)	(2)
Tennessee	(3)	(3)	(3)	(3)	(3)	[5] 259,508	.85
Texas	104	99	.01	84	81	(2)	(2)
Utah	317,717	306,691	29.82	325,961	323,989	4,311,416	14.07
Vermont	-----	-----	.01	100	290	(2)	(2)
Virginia	-----	28	.01	51	100	(2)	(2)
Washington	8,525	8,030	.68	7,407	7,315	64,208	.21
Wyoming	1	-----	(1)	1	-----	15,871	.05
Undistributed	13,321	14,174	1.28	13,987	13,855	[6] 281,001	.92
	1,087,991	1,080,061	100.00	1,092,939	1,090,818	30,645,480	100.00

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[1] Less than 0.01 percent.

[2] Included under "Undistributed"; figures not separately recorded.

[3] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.

[4] Less than 1 ton.

[5] Approximate production through 1928. Figures for 1929–43 confidential and included under "Undistributed."

[6] Includes Tennessee for 1929–43.

In maintaining its lead as the outstanding copper-producing district in 1943, for the eighth straight year, Bingham, Utah, produced 2.4 times as much as the Butte (Mont.) district, its nearest rival. Butte ranked second in the eight years, and in total output from the beginning of operations it easily outdistanced all other areas. The Globe-Miami (Ariz.) district appeared fairly well established in third place in recent years, but capacity operations at the Morenci mine, Morenci (Ariz.) district, would offer a severe threat in 1944.

Details of mine production, by districts and companies, in 1943 are available in the chapters of this volume dealing with production of gold, silver, copper, lead and zinc in the various States.

Mine production of copper in the principal districts of the United States,[1] *1939–43, in terms of recovered copper, in short tons*

District or region	State	1939	1940	1941	1942	1943
West Mountain (Bingham)	Utah	167,856	228,505	264,705	304,687	322,248
Summit Valley (Butte)	Montana	97,266	125,442	127,431	140,349	133,569
Globe-Miami	Arizona	62,400	70,406	82,419	94,265	100,513
Copper Mountain (Morenci)	do	15,878	13,503	13,879	60,356	84,347
Central (including Santa Rita).	New Mexico	42,344	64,991	67,727	72,724	70,628
Ajo	Arizona	49,871	51,566	65,880	66,647	70,069
Robinson (Ely)	Nevada	51,590	63,840	67,171	75,063	64,090
Warren (Bisbee)	Arizona	54,617	55,254	56,592	53,278	50,786
Lake Superior	Michigan	43,985	45,198	46,440	45,679	46,764
Yavapai County (mostly Verde (Jerome) district).	Arizona	38,203	38,201	43,701	44,941	38,386
Mineral Creek (Ray)	do	21,583	31,729	42,400	50,362	37,434
Pioneer (Superior)	do	17,952	18,447	19,119	20,701	18,820
Chelan Lake	Washington	8,786	9,288	8,365	7,955	7,219
Cope	Nevada	14,065	13,542	10,756	7,074	5,133
Klamath River	California	------	------	------	2	5,067
Lordsburg	New Mexico	3,184	3,278	3,734	3,358	2,496
Burro Mountain	do	3	------	1,144	3,656	2,094
Coeur d'Alene region	Idaho	2,068	2,680	2,979	2,993	1,987
Copperopolis	California	------	(2)	1	264	1,930
Tintic	Utah	1,413	1,295	1,042	853	841
San Juan Mountains	Colorado	981	1,209	705	539	554
Ophir	Utah	2,070	1,095	204	202	116
Red Cliff (Battle Mountain)	Colorado	11,921	10,552	5,609	323	115
Plumas County	California	4,029	5,293	3,644	3	7
San Pedro	New Mexico	336	1,394	719	------	------
Swain County [3]	North Carolina	(4)	(4)	(4)	(4)	(4)
Lebanon (Cornwall mine) [3]	Pennsylvania	(4)	(4)	(4)	(4)	(4)
Ducktown [3]	Tennessee	(4)	(4)	(4)	(4)	(4)

[1] Districts producing 1,000 short tons or more in any year of the period 1939–43.
[2] Less than 1 ton.
[3] Not listed in order of output.
[4] Bureau of Mines not at liberty to publish figures.

Quantity and estimated recoverable content of copper-bearing ores.—The following tables list the quantity and estimated recoverable copper content of the ore produced by mines in the United States in 1942; figures for 1943 are not yet available. Of the total copper produced from copper ores in the United States during 1942, 87 percent was obtained from ores concentrated before smelting, 9 percent from direct smelting ores, and 4 percent from ore treated by straight leaching. The percentages for 1942 compared with 85 percent obtained from concentrated ore, 10 percent from direct smelting ores, and 5 percent by straight leaching in 1941.

Close agreement between the output as reported by smelters and the recoverable quantity as reported by mines indicates that the estimated recoverable tenor is close to the actual recovery. Classification of some of the complex western ores is difficult and more or less arbitrary. "Copper ores" include not only those that contain

2.5 percent or more copper but also those that contain less than this percentage if they are valuable chiefly for copper. Mines report considerable copper from ores mined primarily for other metals. These include siliceous gold and silver ores, lead and zinc ores, and pyritic ores.

Copper ore, old tailings, etc., sold or treated in the United States in 1942, with copper, gold, and silver content in terms of recovered metals

State	Ore, old tailings, etc., sold or treated (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore
		Pounds	Percent			
Arizona	32,856,971	[1] 739,722,867	1.13	144,764	4,993,551	$0.26
California	15,944	[1] 1,105,800	3.47	350	13,973	1.39
Colorado	208	26,286	6.32	44	3,189	18.31
Idaho	2,210	190,653	4.31	153	27,390	11.24
Michigan	4,362,640	91,358,000	1.05	----------	61,674	.01
Montana	4,338,714	[1] 271,171,244	3.13	15,261	6,212,356	1.14
Nevada	7,904,443	[1] 160,996,900	1.02	78,548	558,330	.40
New Mexico	7,631,752	[1] 132,995,042	.87	4,815	166,613	.04
Oregon	58	15,400	13.28	2	17	1.41
Texas	506	30,238	2.99	1	2,089	3.01
Utah	33,611,061	[1] 574,381,536	.85	291,806	2,698,515	.36
Washington	717,124	16,036,400	1.12	47,459	173,791	2.49
Eastern States	843,995	[2] 28,351,000	----------	260	40,425	----------
	92,285,626	2,016,381,366	1.09	583,463	14,941,913	.34

[1] Excludes copper recovered from mine-water precipitates as follows: Arizona, 41,734,764; California, 71,100; Montana, 5,327,407; Nevada, 6,172,600; New Mexico, 26,042,745 and Utah 32,062,916 pounds.

[2] Copper from magnetite-pyrite-chalcopyrite ore from Pennsylvania included with that from copper ore.

Copper ore, old tailings, etc., concentrated in the United States in 1942, with content in terms of recovered copper

State	Ore, old tailings, etc., concentrated (short tons)	Concentrates produced (short tons)	Copper produced (pounds)	Copper from ore, etc. (percent)
Arizona	[1] 26,703,329	1,237,214	[2] 491,356,082	0.92
California	12,208	1,619	527,100	2.16
Idaho	560	56	28,400	2.54
Michigan	4,362,640	70,686	91,358,000	1.05
Montana	4,319,953	555,615	269,728,015	3.12
Nevada	7,847,042	299,793	153,609,900	.98
New Mexico	7,555,055	229,599	130,607,425	.86
Utah	33,565,587	894,630	572,293,048	.85
Washington	716,928	34,756	15,972,145	1.11
Eastern States	781,865	[3] 71,890	[4] 25,723,000	----------
	85,865,167	3,395,858	1,751,203,115	1.02

[1] In addition, 4,199,268 tons were treated by straight leaching.

[2] In addition, 87,557,991 pounds of copper were recovered by straight leaching.

[3] Includes concentrates from magnetite-pyrite-chalcopyrite ore from Pennsylvania.

[4] Includes copper from magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Copper ore, old tailings, etc., smelted in the United States in 1942, with content in terms of recovered copper, and copper produced from all sources, in terms of recovered copper

State	Ore, old tailings, etc., smelted			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Short tons	Copper produced (pounds)	Percent of copper	
Alaska	----	----	----	44,000
Arizona	1,954,374	160,808,794	4.11	786,774,000
California	3,736	578,700	7.74	2,116,000
Colorado	208	26,286	6.32	2,204,000
Idaho	1,650	162,253	4.92	6,860,000
Michigan	----	----	----	91,358,000
Missouri	----	----	----	2,600,000
Montana	18,761	1,443,229	3.85	282,388,000
Nevada	57,401	7,387,000	6.43	167,326,000
New Mexico	76,697	2,387,617	1.56	160,200,000
Oregon	58	15,400	13.28	206,000
South Dakota	----	----	----	2,000
Texas	506	30,238	2.99	198,000
Utah	45,474	2,088,488	2.30	613,382,000
Washington	196	64,255	16.39	16,060,000
Eastern States	62,130	2,628,000	2.11	28,404,000
	2,221,191	177,620,260	4.00	2,160,122,000

Copper ores produced in the United States, 1938–42, and average yield in copper, gold, and silver

Year	Smelting ores [1]		Concentrating ores [1]		Total				
	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Short tons [1]	Yield in copper (percent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1938	[2] 2,028,000	4.49	[2] 34,374,026	1.17	[2] 37,794,938	1.34	0.0090	0.414	$0.58
1939	2,396,155	4.61	50,710,026	1.09	55,239,098	1.25	.0085	.333	.52
1940	2,179,060	4.33	63,900,512	1.10	69,278,476	1.20	.0078	.300	.48
1941	2,135,138	4.29	72,531,712	1.06	78,452,504	1.15	.0071	.239	.42
1942	2,221,191	4.00	85,865,167	1.02	92,285,626	1.09	.0063	.162	.34

[1] Includes old tailings, etc.
[2] Exclusive of Alaska, figures for which Bureau of Mines not at liberty to publish.

Refinery production.—The refinery output of copper in the United States in 1943 was made by 11 plants; 7 of these employed the electrolytic method only, 2 the furnace process on Lake Superior copper 1 the furnace process on western ores, and 1 both the electrolytic and the furnace methods.

Five large electrolytic refineries are on the Atlantic seaboard, three Lake refineries on the Great Lakes, and three electrolytic refineries west of the Great Lakes—one at Great Falls, Mont.; one at Tacoma, Wash.; and one at El Paso, Tex. In 1942, fire-refined copper was produced for the first time at the Hurley (N. Mex.) plant of the Kennecott Copper Corporation, and output of this grade was almost doubled at the plant in 1943. The El Paso plant of the Phelps Dodge Refining Corporation produced furnace refined copper in addition to the usual electrolytic grade. Of the plants specified above, the Lake refinery of the Quincy Mining Co. has been idle since 1933.

In addition to the foregoing plants, that at Inspiration, Ariz., is equipped to make electrolytically refined copper direct from the liquors obtained from leaching; this copper is shipped as cathodes to other refineries, where it is melted and cast into merchant shapes.

The 13 plants indicated constitute what commonly are termed "regular refineries." Of these plants, 8 employ the electrolytic process, 4 the furnace process, and 1 both methods. The electrolytic plants have a rated capacity of 1,639,000 tons of refined copper a year. As they produced 1,350,000 tons in 1943, this part of the industry was operated at 82 percent of capacity.

The following tables show the production of refined copper at regular refining plants, classified according to source, grade, and form in which cast.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1939–43, in short tons

	1939	1940	1941	1942	1943
Primary:					
Domestic:[1]					
Electrolytic[2]	662,409	883,610	929,711	963,177	938,727
Lake[2]	42,464	43,629	45,697	46,523	44,867
Casting	----------	----------	----------	55,092	98,485
	704,873	927,239	975,408	1,064,792	1,082,079
Foreign:[1]					
Electrolytic	304,642	386,317	419,901	343,834	297,184
Casting and best select	----------	----------	----------	5,935	----------
Refinery production, new copper	1,009,515	1,313,556	1,395,309	1,414,561	1,379,263
Imports, refined copper[3]	16,264	68,337	346,994	401,436	402,762
Total new refined copper made available	1,025,779	1,381,893	1,742,303	[4]1,815,997	1,782,025
Secondary:					
Electrolytic[5]	116,613	117,669	95,437	83,079	114,259
Casting	----------	----------	4,238	2,064	8,205
	116,613	117,669	99,675	85,143	122,464
Grand total	1,142,392	1,499,562	1,841,978	[4]1,901,140	1,904,489

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as accurate separation at this stage of manufacture is not possible.
[2] Some copper from Michigan is electrolytically refined at eastern refineries and is included as electrolytic copper.
[3] Data include copper imported for immediate consumption plus material entering country under bond.
[4] Revised due to foreign trade changes.
[5] Includes some secondary Lake copper.

Copper cast in forms in the United States, 1942–43

Form	1942		1943	
	Short tons	Percent	Short tons	Percent
Wire bars	582,000	38.81	473,500	31.53
Cathodes	464,500	30.98	503,000	33.50
Cakes	119,500	7.97	145,500	9.69
Ingots	219,500	14.64	265,000	17.65
Other forms	114,000	7.60	114,500	7.63
	1,499,500	100.00	1,501,500	100.00

In addition to the regular refineries, numerous plants throughout the country operate on scrap exclusively, producing metallic copper and a great variety of alloys. The output of these plants is not included in the statements of refined-copper production in the preceding tables but is included in the following statement on secondary-copper production.

Copper sulfate.—The production of hydrous copper sulfate or bluestone by copper refineries in the United States was 30,700 short tons having a copper content of 7,667 tons in 1943 compared with 31,700 tons containing 8,076 tons in 1942.

The output of copper sulfate by plants other than the regular primary refineries totaled 58,400 tons with a reported content of 14,597 tons in 1943 compared with 73,500 (revised) tons containing 18,390 tons of copper in 1942.

Producers held 10,500 tons of copper sulfate at the beginning of 1943, total production was 89,100 tons, and shipments amounted to 79,900 tons. Some small purchases were made during the year, and consumers used an amount equivalent to almost 10 percent of shipments. Inventories at the year end were 14,300 tons.

SECONDARY COPPER

Secondary copper includes material recovered from remelting old copper and copper scrap and from the treatment of copper alloys or alloys treated without separation of the copper. The following table summarizes the production of secondary copper during 1939–43. Further details appear in the chapter on Secondary Metals—Nonferrous.

Secondary copper produced in the United States, 1939–43, in short tons

	1939	1940	1941	1942	1943
Copper recovered as unalloyed copper	151, 370	170, 839	135, 869	114, 647	137, 883
Copper recovered in alloys	[1] 348, 330	[1] 361, 207	[1] 590, 527	[1] 813, 108	[1] 948, 164
Total secondary copper	499, 700	532, 046	726, 396	927, 755	1, 086, 047
From new scrap	212, 800	198, 156	313, 697	500, 633	658, 526
From old scrap	286, 900	333, 890	412, 699	427, 122	427, 521
Percentage of domestic mine output	69	61	76	86	100

[1] Includes copper in chemicals as follows: 1939, 3,200 tons; 1940, 9.431 tons; 1941, 9,804 tons; 1942, 17,455 tons; 1943, 13,019 tons.

CONSUMPTION

The following table gives figures on apparent consumption of copper in the United States. In estimating apparent consumption it has been assumed that copper used in the manufacture of primary fabrications of copper is consumed. It is likely that statistics compiled upon a different basis (for example, by taking consumption as including only copper made into automobiles, electrical equipment, ships, and other items) would show very different results. Much copper leaves the country as primary fabrications and considerably more in manufactured products containing copper. Actual consumption data may be compiled at many points in the industrial process. The method of calculating the quantity of copper available for consumption is shown in the following table. It should be noted that exports and stocks include some refined secondary copper that cannot be determined separately and also that actual consumption of new copper would differ from the figures shown in the table by the changes in consumers' stocks.

New refined copper withdrawn from total year's supply on domestic account, 1939–43, in short tons

	1939	1940	1941	1942	1943
Total supply of new copper	1,025,779	1,381,893	1,742,303	[1] 1,815,997	1,782,025
Stock at beginning of year	181,000	95,500	91,500	77,500	84,000
Total available supply	1,206,779	1,477,393	1,833,803	[1] 1,893,497	1,866,025
Copper exported [2]	396,406	377,108	114,753	[3] 131,406	[3] 175,859
Stock at end of year	95,500	91,500	77,500	84,000	68,500
	491,906	468,608	192,253	[1] 215,406	244,359
Withdrawn on domestic account	714,873	1,008,785	1,641,550	[1] 1,678,091	1,621,666

[1] Revised due to foreign trade changes.
[2] Includes refined copper in ingots, bars, rods, or other forms.
[3] Excludes refined copper in rods.

STOCKS

The following table gives domestic stocks of copper as reported by primary smelting and refining plants. Stocks of blister and anode copper in transit from smelters to refineries are included under blister copper.

Stocks of copper at primary smelting and refining plants in the United States at end of year, 1939–43, in short tons

Year	Refined copper	Blister and materials in process of refining [1]	Year	Refined copper	Blister and materials in process of refining [1]
1939	95,500	260,000	1942	84,000	235,500
1940	91,500	243,000	1943	68,500	241,000
1941	77,500	240,000			

[1] Includes copper in transit from smelters in the United States to refineries therein.

Total inventories in the hands of smelters and primary refineries dropped 3 percent in 1943, owing to a 19-percent fall in the refined grade offset only in part by a 2-percent gain in the unrefined class.

Figures compiled by the Copper Institute show that domestic stocks of refined, duty-free copper declined in 1943 and were 52,121 tons at the year end compared with 65,309 tons at the beginning. The drop in 1943 is an extension of the continuous downtrend from 289,755 tons at the close of 1938. Stock figures of the Copper Institute and the Bureau of Mines are upon different bases and, as a consequence, never agree. Normally the differences are due in part to the somewhat different coverage and in part to an arbitrary but permissible method used by the Copper Institute in designating the copper as domestic or foreign metal. The latter factor causes a time-lag difference between the two sets of figures. Copper Institute stocks cover duty-free metal only.

Refined metal in the hands of the Metals Reserve Co. totaled 224,081 short tons (of which 57,681 were fire-refined) at the end of 1943 compared with 91,472 tons at the end of 1942. This metal duplicates part of that reported at domestic refineries because the former is upon an ownership and the latter upon a physical basis. The exact amount of duplication cannot be determined, but it is not believed to amount to more than 10 percent of the Metals Reserve total.

The fabricators' inventory position improved in 1943, although it was still represented by a minus quantity. Stocks of refined copper, of copper in process, and in primary fabricated shapes were actually 15 percent smaller at the end than at the beginning of the year; the improved position was brought about by a 12-percent fall in working-stock requirements and by a 24-percent drop in unfilled sales to customers. At their all-time peak, unfilled fabricators' sales to customers totaled 689,177 tons at the end of June 1942. By the end of 1943 they had been reduced by nearly one-third.

Stocks of copper in fabricators' hands at end of the year, 1939–43, in short tons

	Stocks of refined copper [1]	Unfilled purchases of refined copper from producers	Working stocks	Unfilled sales to customers	Excess stocks over orders booked
1939	300, 543	189, 687	184, 833	237, 752	67, 645
1940	339, 376	326, 269	240, 740	414, 892	10, 013
1941	292, 973	241, 335	291, 515	547, 468	−304, 675
1942	414, 668	135, 481	340, 547	613, 005	−403, 403
1943	353, 948	90, 807	299, 796	465, 258	−320, 299

[1] Includes in process metal and primary fabricated shapes. Also includes refined copper held at refineries for fabricators' account.

PRICES

Reports to the Bureau of Mines from copper-selling agencies indicate that 1,150,000 tons of copper were delivered to domestic and foreign purchasers (excluding deliveries of foreign copper to the Metals Reserve Co.) in 1943 at an average price (f. o. b. refinery) of 11.8 cents a pound, unchanged from 1942 and 1941. The averages for 1943 and 1942 exclude bonuses paid for overquota outputs of individual mines, which were first applicable to February (1942) tonnages. Bonus payments added 0.3 to 0.4 cent a pound to the average realization for copper in 1942, although revised figures available after 1942 mine values had been calculated showed the bonus increment to have been somewhat higher. The difference was added to the 1943 figures, and upon this basis the bonus average for the year was 1.2 cents. The bonus payments, of course, did not apply to all production or, for that matter, to as much as one-fourth of it in 1943 or one-tenth in 1942. In an address at a meeting of the American Mining Congress, Denver, Colo., January 1944, F. H. Hayes of the War Production Board stated that out of a total production of 1,104,622 tons (differs slightly from Bureau of Mines total), there were 825,713 tons on which no premium prices were paid compared with 986,154 tons in 1942, and 246,612 tons on which premiums were paid compared with 102,435 tons in 1942; 32,297 tons in 1943 were produced under Reconstruction Finance Corporation contracts.

Average monthly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States, 1942–43, in cents per pound

Month	1942			1943		
	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]
January	11.87	11.775	11.508	11.87	11.775	11.700
February	11.87	11.775	11.700	11.87	11.775	11.700
March	11.87	11.775	11.700	11.87	11.775	11.700
April	11.87	11.775	11.700	11.87	11.775	11.700
May	11.87	11.775	11.700	11.87	11.775	11.700
June	11.87	11.775	11.700	11.87	11.775	11.700
July	11.87	11.775	11.700	11.87	11.775	11.700
August	11.87	11.775	11.700	11.87	11.775	11.700
September	11.87	11.775	11.700	11.87	11.775	11.700
October	11.87	11.775	11.700	11.87	11.775	11.700
November	11.87	11.775	11.700	11.87	11.775	11.700
December	11.87	11.775	11.700	11.87	11.775	11.700
Average for year	11.87	11.775	11.684	11.87	11.775	11.700

[1] As reported by American Metal Market Co.
[2] As reported by Engineering and Mining Journal.

Average yearly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States and for spot copper at London, 1934–43, in cents per pound

	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
Domestic f. o. b. refinery [1]	8.53	8.76	9.58	13.27	10.10	11.07	11.40	11.87	11.87	11.87
Domestic f. o. b. refinery [2]	8.428	8.649	9.474	13.167	10.000	10.965	11.296	11.797	11.775	11.775
Export f. o. b. refinery [2]	7.271	7.538	9.230	13.018	9.695	10.727	10.770	10.901	11.684	11.770
London spot [2] [3]	7.496	7.753	9.465	13.097	9.912	[4] 10.066	([5])	([5])	([5])	([5])

[1] As reported by American Metal Market Co.
[2] As reported by Engineering and Mining Journal.
[3] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board of Treasury.
[4] Average for 8 months; thereafter, London Metal Exchange dealings suspended for duration of war.
[5] No quotations.

Ceiling price limitations of the Office of Price Administration placed on electrolytic and casting copper in 1941 were described in the Copper chapter of Minerals Yearbook, 1941. These ceilings were unchanged in 1942 and 1943, except for l. c. l. sales described in the 1942 report. The bonus plan established to enable the Metals Reserve Co. to buy copper from high-cost properties and from high-cost sections of other mines, beginning February 1, 1942, at 5 cents a pound above the ceiling price, to increase production, and liberalization of the original plan are discussed in the chapter for 1942. The principal change in 1943 was in the downward revision of numerous production quotas to enable a larger portion of total production to partake of bonus benefits, as already indicated. In November, however, it was announced that no applications for special premiums postmarked after December 31, 1943, would be accepted.

Price revisions for scrap items are discussed in the chapter on Secondary Metals—Nonferrous.

The official maximum prices, delivered to consumers' plants, have prevailed in the London market since December 18, 1939:

	Per long ton £	s.	d.
Electrolytic, high conductivity	62	--	--
Fire refined:			
High conductivity	62	--	--
High grade	61	10	--
Minimum, 99.7 percent	61	--	--
Minimum, 99.2 percent	60	10	--
Hot-rolled black wire rods	65	10	--

FOREIGN TRADE [6]

The war has disrupted normal conditions in copper smelting and refining whereby the excess capacities in the United States were used to reduce crude materials from abroad for reshipment from the country as refined metal or as fabricated products. A move toward greater independence in the production of higher grades of copper at sources of the ores is in progress, but the custom reduction facilities of the United States continue in demand. As has been pointed out in previous Minerals Yearbook reports, the war has widely disrupted normal shipping. The Allies needed all possible copper for the construction of armament that could compete with and surpass those built by their enemies, who had spent long years in preparation for war. Shipping equipment was inadequate to bring all materials of all kinds required to the United States, and the dangers of sinking made it necessary to have reserve tonnages for high-priority materials. Consequently stress was laid on obtaining as much refined and blister copper as possible first and then accepting the lower grades. The unprecedented ship-construction program of the United States Maritime Commission and the success of the Allies in reducing the submarine menace improved shipping conditions in 1943. The expanding armament program, however, called for greater imports, and invasion preparations called for unbelievable numbers of bottoms. Refined and blister copper continued high on the shipping priority list, however, and refined metal was received in the United States at virtually the 1942 rate. Imports of unrefined copper in pigs or converter bars dropped 16 percent, probably because of limited periods of shipping deficiency. Virtually all of the refined copper entering the country comes from Chile, which also dominates the blister class to a lesser degree. This same country dominated the two classes in the pre-war period also, but at that time most of Chile's copper was going to Europe. Except for the copper from Africa, which was chiefly to be refined under bond for reexport, there were no significant imports of copper outside of the Western Hemisphere in 1943.

Destinations of exports have shown much greater changes because of the war than have sources of imports, due largely to the fact that after the war began some of our former customers became our enemies, and some were under enemy domination or were unfortunately located neutrals. These conditions eliminated six of the seven chief pre-war buyers of United States copper: Japan, Germany, Italy, France, Belgium, and Sweden. Of the pre-war group, the United Kingdom continues an outstanding customer and now dominates the export market; it received 95 percent of the refined copper (by far the most important export class) shipped out of the country in 1943.

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[6] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Total imports of unmanufactured copper in 1943 were less than the successive peak rates for 1941 and 1942. Exports of metallic copper gained 40 percent over the relatively low rate for 1942.

As always, the copper-export movement is grossly understated if the totals used cover refined copper and primary manufactures only. The understatement is greater in these astounding war days, when measureless quantities of copper are leaving the country in the form of airplanes, tanks, landing craft, jeeps, ordnance materials, electrical equipment, and other varied items.

IMPORTS

As has already been indicated, refined copper was the most desired class of copper imports again in 1943, and receipts of this type were virtually unchanged from the peak rate attained in 1942, being 0.3 percent higher. The shift from crude to refined grades is brought out boldly by the following comparisons. Imports of refined copper in 1942 and 1943 averaged 33 times the annual average for the 5-year period 1935–39. Refined imports made up 57 percent of the total in 1943, 53 percent in 1942, and only 4 percent in 1935–39. More than 98 percent of the refined copper entered in 1943 came from Chile, from mines controlled in the United States, and 99.8 percent in 1942—or, as a matter of fact, virtually all of it—as has been the case since the 4-cent excise tax was placed on copper in 1932. Copper entered in the form of concentrates, regulus, and pigs and converter bars declined 7, 23, and 16 percent, respectively, in 1943; on the whole, the smaller quantities were shared in by most contributing countries. The largest decline was in receipts of regulus and pigs and converter bars from Belgian Congo, followed by loss in imports of the same classes from the Union of South Africa. Some exceptions to the general trend for the unrefined classes mentioned were as follows: More concentrates were received from Bolivia. Ecuador not only shipped more than twice as much copper to the United States, but the grade in 1943 was chiefly blister copper as against mainly concentrates in 1942. Concentrates from Newfoundland showed a gain in 1943.

Other items in the import picture in 1943 that are worthy of note were the receipt of quantities of concentrates from Cyprus and of pigs and converter bars from Turkey. These entries may signify an easier shipping situation in the Mediterranean, following termination of the African campaign in favor of the Allies. For the first time copper in refined form was received from Peru. The quantity reported as received in 1943 was above the reported capacity of the small electrolytic plant in that country.

Copper (unmanufactured) imported into the United States, 1942–43, by countries, in short tons [1]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper, fit only for remanufacture, and scale and clippings
1942						
Africa, British:						
Southern Rhodesia		321	23	4,201		
Union of South		16	4,252	13,637		
Argentina	2	55				
Australia	3,391	40		162		
Belgian Congo		(2)	62,118	26,932		
Bolivia	304	5,075				
Burma		355	1,249			
Canada	14	27,476	297	5,809	820	568
Chile	504	6,691	(2)	92,247	400,616	
Colombia		8				
Cuba		8,867			(2)	227
Ecuador		1,478	269			
Mexico	790	4,957		51,657		
Newfoundland and Labrador		4,087				
Peru	516	5,501	358	24,234		
Philippine Islands	(2)	[3] 256				
Other countries	6	5	(2)	3,740		262
	5,527	65,188	68,566	222,619	401 436	1,057
1943						
Africa, British:						
Southern Rhodesia		108	10			
Union of South	2,352	953	11	587		
Argentina		95				
Australia	277	402				
Belgian Congo		82	51,013	17,745	4,405	
Bolivia	913	5,387				
Canada	1	23,036	1,329	5,024	323	476
Chile	3,087	5,729	56	83,241	396,362	1,323
Cuba		7,758				127
Cyprus		2,762				
Ecuador		18	409	4,442		
Mexico	417	6,008	9	44,835		
Newfoundland and Labrador		4,849				
Panama: Canal Zone						409
Peru	735	3,509	49	27,277	1,672	
Turkey				2,342		
Other countries	2	9	1	829		52
	7,784	60,705	52,887	186,322	402,762	2,387

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[1] Data include copper imported for immediate consumption plus material entering the country under bond.
[2] Less than 1 ton.
[3] Some copper in "ore" and "other" from Philippine Islands is not separately classified and is included under "concentrates."

Copper (unmanufactured) imported [1] *into the United States, 1939–43*

Year	Short tons	Year	Short tons
1939	336,297	1942	764,393
1940	491,342	1943	712,847
1941	735,545		

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[1] Data include copper imported for immediate consumption plus material entering country under bond.

EXPORTS

Total exports of copper as refined metal and as primary fabricated shapes rose 40 percent in 1943. This move continued the rise from the low levels reached in 1941, when the export total surpassed only those for 1933, 1932, and 1901 of the present century. The chief class of exports is refined copper in bars, ingots, and other forms; of this class 95 percent went to the United Kingdom in 1943. Mexico received less than 4 percent. One feature of export trade in recent years has been the enormous growth in shipments of insulated wire and cable. This class totaled 92,756 tons in 1943, or 54 percent above 1942, which in turn was 119 percent above 1941. The U. S. S. R. received 54 percent of the 1943 total and 53 percent in 1942. The United Kingdom received 12 percent of the 1943 total and less than 4 percent in 1942. All the next most important destinations are significant because of their association with the war—India, Egypt, New Zealand, Australia, and Algeria. The U. S. S. R. was also the principal destination of other wire and primary fabricated shapes. Few of the other items appear to have importance. The chapter on Copper in Minerals Yearbook, 1942, indicated that the principal prewar destinations of United States exports were Japan, Germany, the United Kingdom, Italy, France, Belgium, and Sweden. The United Kingdom is our present best customer, and the others are either enemies or under enemy domination, except neutral Sweden which cannot be considered to have complete independence of action. Sweden would have been glad to get copper from the United States and its failure to obtain any may be credited to Germany's undoubted acquiescence to such a move.

The following table gives the destinations of exports of copper and primary manufactures in 1943. The chapter on Copper in Minerals Yearbook, 1941, contains a table showing exports by countries for 1937 to 1940 that indicates the revolution in flow of copper from the United States since the outbreak in Europe of World War II.

Copper exported from the United States, 1943,[1] by countries, in short tons

	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
Algeria		58	102		14	47	35	2,065	(3)
Argentina		5	(2)		42	7	1	108	
Australia		1	5		(2)	3	7	2,475	
Brazil		726	12		73	56	76	402	
Canada		162	189	(2)	183	51	46	1,441	
Chile	1	9	14		28	33	91	618	
China			14		335	23	151	362	
Colombia		154	(2)		10	97	210	697	
Cuba		7	4		169	29	125	961	
Egypt		1	(2)		(2)	(2)	198	4,455	
India and Dependencies		3			22	2	92	5,949	
Mexico	1	6,404	15		205	93	294	942	
Morocco (French)			31		33	36	8	28	
New Zealand		(2)	(2)		19	3	2,059	3,562	
Panama: Republic of		(2)			2		3	65	
Peru		10	1		46	42	146	506	
Portugal			2		13	70	33	37	
U. S. S. R.		1,403	1,077		8,599	5,890	2,333	50,134	
United Kingdom[4]	1,238	166,750	8		(2)	562	482	11,456	
Venezuela		1	(2)		14	49	221	888	
Other countries		165	8		127	198	564	5,605	
	1,240	175,859	1,482	(2)	9,934	7,291	7,175	92,756	(3)
Total value	$299,232	$36,893,683	$578,806	$133	$10,355,836	$3,161,158	$2,904,797	$53,436,643	$1,120,696

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[1] Changes in table in Minerals Yearbook, 1942, p. 150, are as follows: Refined bars, ingots or other forms exported to United Kingdom should read 107,949 short tons, other countries 160 tons, total 131,406 tons; old and scrap exported to United Kingdom should read 112 tons, other countries 1,102 tons, total 1,215 tons; insulated wire and cable exported to Egypt should read 8,788 tons, other countries 7,078 tons, total 60,393 tons.

[2] Less than 1 ton.

[3] Figures for quantity not recorded.

[4] United Kingdom of Great Britain and Northern Ireland.

Copper [1] exported from the United States, 1939–43

Year	Short tons		Total value	Year	Short tons		Total value
	Metallic [2]	Total			Metallic [2]	Total	
1939	427, 517	427, 579	$96, 321, 365	1942	210, 518	213, 942	$78, 563, 236
1940	427, 650	427, 944	108, 534, 217	1943	294, 497	295, 737	107, 630, 288
1941	158, 893	158, 905	46, 196, 275				

[1] Exclusive of "other copper manufactures" valued at $863,561 in 1939; $1,584,441 in 1940; $1,493,265 in 1941; $3,759,403 in 1942; and $1,120,696 in 1943.

[2] Exclusive of ore, concentrates, and composition metal; exclusive also of unrefined copper, figures for which are not separable from those for ore and concentrates.

Brass and bronze exported from the United States, 1942–43, by classes

Class	1942		1943	
	Short tons	Value	Short tons	Value
Ingots	268	$85, 342	227	$64, 161
Scrap and old	168	28, 333	6	1, 097
Bars and rods	10, 689	3, 719, 266	21, 833	8, 360, 652
Plates and sheets	63, 172	24, 056, 349	75, 640	29, 160, 228
Pipes and tubes	2, 752	1, 784, 002	5, 952	3, 876, 151
Pipe fittings and valves	1, 694	1, 862, 328	1, 153	1, 935, 113
Plumbers' brass goods	230	360, 756	160	308, 182
Wire of brass or bronze	3, 517	1, 496, 365	4, 490	2, 326, 589
Brass wood screws	(1)	64, 610	(1)	67, 239
Hinges and butts of brass or bronze	(1)	56, 956	(1)	27, 658
Other hardware of brass or bronze	(1)	341, 160	(1)	213, 994
Other brass and bronze manufactures	(1)	6, 398, 795	(1)	5, 252, 170
	------------	40, 254, 262	------------	51, 593, 234

[1] Weight not recorded.

Unmanufactured brass exported from the United States, 1939–43

[Ingots, bars and rods, and plates and sheets]

Year	Short tons	Value	Year	Short tons	Value
1939	6, 476	$1, 946, 578	1942	74, 129	$27, 860, 957
1940	90, 907	30, 801, 796	1943	97, 700	37, 585, 041
1941	39, 497	14, 558, 425			

Copper sulfate (blue vitriol) exported from the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	14, 620	$1, 157, 498	1942	35, 082	$3, 443, 922
1940	27, 740	2, 293, 983	1943	30, 367	3, 074, 668
1941	34, 511	2, 950, 714			

WORLD PRODUCTION

The lifting of some of the secrecy surrounding statistical information in recent months leaves productive activity in most European and Asiatic countries still obscure. As has been pointed out in previous reports, copper is one of the commodities in which the Axis countries are notably deficient. The Allies control all of the largest sources of production, and the expanded output from them has been insufficient to accommodate more than war and most essential civilian needs. Out of probable world totals of approximately 2,800,000 metric tons of newly mined copper both in 1942 and 1943, the Axis had access to not much more than 300,000 tons a year, or possibly as little as 10 percent but surely not more than 13 or 14 percent of the total. The program of the Allied Governments in connection with the use of copper undoubtedly has been on the safe side; and, of course, the Germans and the Japanese were accumulating stocks of metal during years when the Allies were thinking along peaceful lines. Nevertheless, the disparity between the quantities available to the two contestants tells a story of hardship for the Axis that a lengthening war cannot fail to accentuate. Substitution, even to an unbelievable degree, cannot erase the problem copper presents to the Axis Powers. Germany cannot again obtain large amounts of metal from intensive scrap drives at home and in conquered countries and from the robbing of industries and homes in both locations of copper-containing articles that were in use. As Japanese-conquered territory is not highly industrialized, it is not believed to have yielded large amounts of copper in secondary form.

World mine and smelter production of copper, 1939–43, in metric tons

[Compiled by B. B. Waldbauer]

Country	Mine					Smelter				
	1939	1940	1941	1942	1943	1939	1940	1941	1942	1943
North America:										
Canada	276,157	297,371	291,802	273,819	262,624	[1] 229,367	[1] 256,294	[1] 254,493	(2)	(2)
Cuba	9,964	9,559	9,838	[3] 8,916	6,310					
Mexico	44,390	37,602	48,716	51,379	49,774	39,045	31,252	40,914	(2)	(2)
Newfoundland	10,341	9,426	6,651	5,666	5,669					
United States	660,717	796,582	869,214	979,811	989,568	[4] 698,323	[4] 922,364	[4] 1,015,346	[4] 1,111,458	[4] 1,103,918
	1,001,569	1,150,540	1,226,221	1,319,591	1,313,945	966,735	1,209,910	(2)	(2)	(2)
South America:										
Bolivia [3]	4,056	6,660	7,274	6,376	6,011					
Brazil	14	(2)	(2)	(2)	(2)					
Chile	339,173	352,010	465,467	489,158	498,722	324,591	336,861	453,594	477,733	489,320
Ecuador	2	1,133	2,894	(2)	(2)				(2)	(2)
Peru	35,616	43,965	36,822	36,572	38,000	34,115	33,678	28,289	29,473	28,349
	378,861	(2)	(2)	(2)	(2)	358,706	370,539	481,883	507,206	(2)
Europe:										
Belgium						[5] 65,850	(2)	(2)	(2)	(2)
Bulgaria	320	560	(2)	(2)	(2)					
Finland	11,797	[6] 20,000	[6] 18,000	(2)	[6] 18,000	13,246	(2)	[6] 18,000	(2)	[6] 18,000
France	(7)	(2)	(2)	(2)	(2)	(7)	(2)	(2)	(2)	(2)
Germany [6 8] Austria [6 8]	30,000	35,800	(2)	(2)	(2)	[9] 66,000	(2)	(2)	(2)	(2)
Hungary	(7)	(2)	(2)	(2)	(2)					
Italy	(7)	(2)	(2)	(2)	(2)	(7)	(2)	(2)	(2)	(2)
Norway	20,358	[8] 20,000	(2)	(2)	(2)	[8] 10,515	[6] 7,250	(2)	(2)	(2)
Portugal	(7)	(2)	(2)	(2)	(2)					
Rumania	(7)	(2)	(2)	(2)	(2)	(7)	(2)	(2)	(2)	(2)
Spain	(7)	(2)	(2)	(2)	(2)	10,445	9,422	8,900	7,070	9,288
Sweden	9,610	(2)	(2)	(2)	(2)	11,076	[6] 12,500	(2)	[6] 12,000	[6] 17,000
U. S. S. R. [10]	[11] 144,000	[11] 157,000	(2)	[6 11] 160,000	(2)	144,000	157,000	(2)	[6] 160,000	(2)
United Kingdom	(7)	(2)	(2)	(2)	(2)	[6] 4,000	[6] 4,500	(2)	(2)	(2)
Yugoslavia	64,200	(2)	(2)	(2)	(2)	41,658	[8] 42,951	(2)	(2)	(2)
	(7)	(2)	(2)	(2)	(2)	(7)	(2)	(2)	(2)	(2)

See footnotes at end of table.

World mine and smelter production of copper, 1939–43, in metric tons—Continued

[Compiled by B. B. Waldbauer]

Country	Mine					Smelter				
	1939	1940	1941	1942	1943	1939	1940	1941	1942	1943
Asia:										
Burma	[6] 3,365	(2)	(2)	(2)	(2)					
China [12]	1	(13)	[14] 163	(2)	(2)	1	(13)	[14] 163	(2)	(2)
Cyprus	24,384	(2)	(2)	(2)	(2)					
India, British	(7)	(2)	(2)	(2)	(2)	6,640	[8] 6,900	(2)	(2)	(2)
Japan:										
Japan Proper	[6] [11] 104,000	[6] [11] 125,000	(2)	(2)	(2)	[6] 104,000	[6] 125,000	(2)	(2)	(2)
Taiwan	[6] 4,000	[6] 4,000	(2)	(2)	(2)					
Netherlands Indies	94	(2)	(2)	(2)	(2)					
Philippine Islands	7,496	9,259	[6] 9,900	(2)	(2)					
Turkey	[11] 5,917	[11] 8,731	[11] 10,500	(2)	(2)	5,917	8,731	10,500	8,300	[6] 8,500
U. S. S. R.	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)
	(7)	(2)	(2)	(2)	(2)	[10] 116,558	(2)	(2)	(2)	(2)
Africa:										
Algeria	(7)	(2)	(2)	(2)	(2)					
Belgian Congo	[11] 122,649	[11] 148,804	[11] 162,167	[11] 165,938	[11] 156,937	122,649	148,804	162,167	165,938	156,937
Rhodesia:										
Northern	(7)	[11] 266,605	[11] 245,622	[11] 254,654	(2)	215,065	266,605	245,622	254,654	251,107
Southern	(7)	(2)	(2)	(2)	(2)					
South-West Africa	3,530	1,485	(2)	(2)	(2)					
Union of South Africa	10,998	13,350	(2)	(2)	(2)	14,089	17,024	20,019	30,445	[15] 15,661
	(7)	(2)	(2)	(2)	(2)	351,803	(2)	(2)	(2)	(2)
Oceania: Australia	19,800	(2)	(2)	(2)	(2)	20,219	22,680	(2)	[6] 23,000	(2)
	2,251,000	(2)	(2)	(2)	(2)	[6] 2,182,000	(2)	(2)	(2)	(2)

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[1] Copper content of blister produced.
[2] Data not available.
[3] Copper content of exports.
[4] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1939, 646,524 tons; 1940, 824,703 tons; 1941, 876,401 tons; 1942, 987,004 tons; 1943, 991,492 tons.
[5] Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from Belgian Congo and would therefore duplicate output reported under the latter country.
[6] Approximate production.
[7] Estimate included in total.
[8] According to Yearbook of American Bureau of Metal Statistics.
[9] Exclusive of material from scrap.
[10] Output from U. S. S. R. in Asia included under U. S. S. R. in Europe.
[11] Smelter product.
[12] Exports of ingots and slabs.
[13] Less than 1 ton.
[14] January to August, inclusive.
[15] January to September, inclusive.

REVIEW BY COUNTRIES

Belgian Congo.—Output of copper dropped from 165,938 metric tons in 1942 to 156,937 tons in 1943. As indicated in the Copper chapter, Minerals Yearbook, 1942, a severe drought lasting several months in the early part of 1943 had threatened to cause a drop of as much as 20,000 tons. A booklet prepared by the Belgian Information Office states that the entire production of copper in the Belgian colonies is controlled by the Union Minière du Haut Katanga, a large company with a capital of 300 million francs. The report indicates that the main concession is some 200 miles long by 30 miles broad and appears to contain over 4½ million tons of copper. The two biggest mines, Prince Leopold and Kambove, are equipped with electric mining gear and automatic decaging equipment. The Jadotsville mill is equipped to handle 100,000 tons of ore a month and produces a 35-percent product. Another concentrating plant is at Kipushi. There is also an electrolytic plant for the production of cathode copper and electric furnaces especially designed to produce copper-cobalt-iron alloys direct from ore in which all three occur.

Canada.—Copper production in Canada has declined continuously since the peak output was attained in 1940; in 1943, 289,491 short tons were produced, according to preliminary figures, compared with 301,831 tons in 1942, 321,658 in 1941, and 327,797 in 1940. The 1943 rate was exceeded also by that for 1939. The quantities for the 5 years beginning in 1939, however, all represented record tonnages in relation to earlier years and were chiefly in response to the British Empire needs for war materials. The falling production is explained largely by the fact that the greater part of Canada's total copper comes from nickel-copper ores and that in recent years more stress has been placed on the production of nickel than on copper. As a result, a record nickel output was made in 1942, and the peak rate was relatively maintained in 1943. The short labor supply in Canada in 1943 therefore tended to have a more adverse effect on copper than on nickel.

In the early part of 1944 negotiations were under way to extend the contracts entered into in 1939 between the chief copper producers and the Imperial Government to the end of that year. The Granby and Britannia mines in British Columbia are under contract through War Supplies, Ltd., with the Metals Reserve Co.

The annual review number of the Northern Miner, December 16, 1943, calls attention to the problems that impeded mining in British Columbia. The shortage of labor interfered not only with immediate production but by forcing a reduction in development work jeopardized future output as well. In January 1943 the Britannia mine was said to have had over 900 men on its pay roll and to have produced 1,100 tons of copper; 6 months later, with a crew almost one-third smaller, production was down to 725 tons. Granby's rate of output had been reduced from over 1,500 tons a month in January to 850 tons when the article was written.

More than half of the copper produced in Canada comes regularly from the nickel-copper mines of the Sudbury district, Ontario. The International Nickel Co. of Canada, Ltd., as usual was the leading producer in Canada as well as in Ontario in 1943. This company directed its central effort toward expanding supplies of nickel. Deliveries of its own copper in all forms totaled 265,000,000 pounds in 1943 compared with 334,000,000 pounds in 1939. The Falconbridge Nickel Mines, Ltd., also in Ontario, produced 6,047 tons of copper in matte in 1943 compared with 5,762 tons in 1942. This copper was equivalent to between 50 and 60 percent of the nickel output in the 2 years.

Quebec is usually the second largest copper-producing Province, and the principal producer therein is Noranda Mines, Ltd. Its Horne mine produced 33,082 tons of copper from 952,665 tons of ore smelted in 1943 compared with averages of 36,753 and 1,043,265 tons, respectively, in the past 10-year period. The smelter treated 1,380,738 tons of ore, concentrates, and slag, including 428,073 tons of custom material, and produced 68,733 tons of anodes. Ore reserves totaled 5,174,000 tons averaging 7.03 percent copper and 17,460,000 tons containing 0.90 percent, plus some siliceous fluxing ore. Waite Amulet Mines, Ltd., produced nearly 25,000 tons of copper in 1943, or substantially the equal of 1942 and 1941 output.

Copper is produced along the Manitoba-Saskatchewan border in the Flin Flon district by Hudson Bay Mining & Smelting Co., Ltd., and by Sherritt Gordon Mines, Ltd. Production by Hudson Bay, including its wholly owned subsidiary, Emergency Metals, Ltd., totaled 48,381 tons in 1943 (a new record rate) compared with 36,572 tons in 1942 and 33,820 tons in 1941. Ore milled aggregated 2,291,628 tons in 1943, 2,189,767 in 1942, and 2,020,232 in 1941. According to the Northern Miner of March 23, 1944, all Provinces in Canada except Saskatchewan have shown a reduction in copper output since 1940. The gain in Saskatchewan is due to the shifting of productive activity on the Hudson Bay ore body that lies astride the boundary line between this Province and Manitoba. As of January 1, 1943, Hudson Bay ore reserves were estimated at 27,378,240 tons, averaging 2.59 percent copper. All available manpower was required for production, to the consequent detriment of reserves. Sherritt Gordon Mines, Ltd., produced 13,480 tons of copper in 1943 compared with 15,326 tons in 1942.

Chile.—As usual, Chile easily ranked second among the copper-producing countries of the world in 1943; it was the only important foreign country to continue to establish new high records. Its mine total for 1943 was 498,722 metric tons, which was close to half of that for the United States and slightly less than double that for Canada, which ranked third. In 1942 Chile produced 489,158 tons and in 1941, 465,467 tons, successive peak records. As has been pointed out in previous reports, the enormous expansion in production of copper in Chile was due to the heavy orders placed by the United States for all possible supplies of this metal to fill its astounding war requirements. Before the war copper from Chile had gone principally to European countries; after the war began, shipment to its usual market presented an insuperable problem, even before Chile broke with the Axis Powers.

The fact that three North American companies produce almost all of Chile's copper is well known. These companies are the Chile Exploration Co., the Braden Copper Co., and the Andes Copper Mining Co., with mines at Chuquicamata, Sewell, and Potrerillos, respectively. Chile and Andes are subsidiaries of the Anaconda Copper Mining Co., and Braden is a subsidiary of the Kennecott Copper Corporation. A recent Bureau of Mines report [7] gave estimated reserves at Chuquicamata as over a billion tons of known and probable ore containing about 2 percent copper, plus a corresponding amount of possible ore. There seems to be little reason to question that this is the largest copper deposit in the world. The mine is situated at an elevation of 9,200 to 10,000 feet, 13 miles north of Calama, a small town in the valley, on the Antofagasta-Bolivia Railway 147 miles inland from the port of Antofagasta. Chuquicamata is also connected with the port of Tocopilla by 100 miles of good automobile road.

The Braden (El Teniente) mine is credited by the report with estimated reserves of 225,000,000 tons of 2-percent sulfide copper, or sufficient for 60 years of normal operation. It is located in the Province of O'Higgins, 30 miles northeast of Rancagua, a town on the longitudinal railway 50 miles southeast of Santiago. Andes reserves are estimated at 75,000,000 tons of ore averaging 2 percent copper, only enough for about 8 years' operation at the present rate. This mine is situated about 75 miles due east of Barquito, the company port in the Province of Atacama.

More details concerning these properties, as well as descriptions of other copper and other mines, are given in the Bureau of Mines report mentioned, as well as discussions on economic conditions affecting all kinds of mining in the country. It states that the copper industry is the source of about one-third of the Government revenue.

A copper-fabricating plant was purchased by Chile in 1943 from the General Cable Co., Pawtucket, R. I. The Engineering and Mining Journal of August 1943 said that it should be ready for production early in 1944 and that its capacity was 12,000 tons a year, but that it would probably operate at only one-third of that rate at first.

Employment in copper mines averaged 20,500 men in 1943 compared with 19,600 in 1942, 18,300 in 1941, and 14,200 in 1936.

A new Metals Reserves Co. contract with Chile was negotiated in March 1944. This contract called for a reduction in price.

Cuba.—Copper production in Cuba amounted to 6,310 metric tons in 1943, marking an extension of the almost continuous decline from the 14,431-ton output for 1938, the peak in recent years. The 1941 annual report of the American Metal Co., Ltd., which owned a 59-percent interest at the time stated that it was impossible to replenish ore reserves in the Matahambre mine (the largest copper producer in Cuba) as rapidly as they were extracted. A recent financial statement on the American Metal Co., Ltd., indicated that the Matahambre investment had been written off its books in 1943. Foreign Commerce Weekly of June 3, 1944, said that the American interest in the mine had been disposed of to the Cuban stockholders. The Metals Reserve contract, at a price above the ceiling quotations, has aided in keeping the property in the productive column. The contract was scheduled to lapse in March 1944 but was extended through June with a reduction in price. Imports of Cuban copper in concentrates into the United States totaled 7,038 metric tons in 1943 compared with 8,044 tons in 1942.

Mexico.—Mine output of 49,774 metric tons in 1943 was slightly below 1942 but virtually at the level for that year. Production from

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[7] Foreign Minerals Survey, Bureau of Mines, Present Situation in Chile's Mining Industries: Vol, 1, No. 4, March 1944, 40 pp.

1941 to date has been above the rate for the previous 10 years due, no doubt, to the agreements between the Mexican and United States Governments, which have tended to stimulate the outputs of numerous items. Exports of copper (metallic content) aggregated 49,975 tons compared with 50,668 in 1942.

The extension of plant facilities at Cananea, Sonora, by the Cananea Consolidated Copper Co., S. A., subsidiary of the Anaconda Copper Mining Co., mentioned in Minerals Yearbook, 1942, was reported to have progressed satisfactorily in 1943 and to be scheduled for completion in 1944.

Under contract with the Metals Reserve Co., as of November 1, 1942, the Moctezuma Copper Co. mined 294,536 tons of concentrating ore in 1943 compared with 251,986 tons in 1942. In addition, 414 tons of direct smelting oxide ore were produced in 1943. Stopes on the 1,400 and 1,500 levels were brought into production, and the mine was unwatered to the 1,800 level. This company is a subsidiary of the Phelps Dodge Corporation.

Northern Rhodesia.—Copper smelter output in Northern Rhodesia amounted to 251,107 metric tons in 1943 compared with 254,654 tons in 1942 and with 266,605 tons in 1940, the peak year. The better position of the United Nations in regard to supplies of copper at the end of 1943 led to reports that Rhodesian production of copper was to be reduced 20 to 25 percent because of a decision of the British Government to curtail its purchases there. One important factor in the somewhat easier situation was the greatly improved prospect that metal shipments would arrive at their destination, which is a tribute to the United Nations navies. The proposed decrease was said to apply proportionately to N'Kana, operated by Rhokana Corporation, Roan Antelope Copper, and Mufulira. N'Changa's share in the decrease was to be its failure to go ahead with the installation of extra plant facilities requested by the British Ministry of Supply in April 1943. The excess in United Nations supply soon proved to be a myth, however, and plans to reduce production were momentarily sidetracked. Any excess over Empire needs, it was said, would go to the United States.

The Northern Miner of February 3, 1944, points out that ownership of African copper properties is essentially British, but that the American interest through the American Metal Co., Ltd., and the Newmont Mining Co. is large. The American Metal Co., Ltd., owns roughly 32 percent of Roan Antelope Copper Mines, Ltd., and also slightly over 50 percent of Rhodesian Selection Trust, Ltd., which has a 64.07-percent interest in Mufulira Copper Mines, Ltd. Newmont Mining Co., through its substantial holdings in Rhodesian Anglo-American, Ltd., the largest stockholder in Rhokana Corporation, has an indirect but important interest in the Rhodesian field. Rhokana Corporation owns the N'Kana property and has a 32-percent interest in Mufulira Copper Mines and a 47.4-percent interest in N'Changa Consolidated Copper Mines, Ltd.

Peru.—The ready market for copper in recent years has failed to bring forth substantially increased amounts of metal from Peru. Mine output in this country is estimated at about 38,000 metric tons in 1943 compared with 36,572 in 1942 and with an average of 34,370 tons in the 5-year period 1935–39. As usual, the Cerro de Pasco Copper Corporation was the outstanding producer in the country, followed by the Northern Peru Mining & Smelting Co., Compagnie des Mines de Huaron, and Sociedad Minera Puquio Cocha. Cerro de Pasco began to produce electrolytic copper on a small scale in March 1942. This company also completed a new 800-ton daily capacity concentrator in October 1943 and began to treat copper ores there, although the mill was designed originally for lead-zinc ores. The copper content of exports in 1943 amounted to 31,132 metric tons compared with 35,139 tons in 1942. In continuing the over-all metals agreement with Peru, the United States Government arranged to buy until June 30, 1944, all copper produced up to 125 percent of the 1942 output.

Sweden.—As pointed out in Minerals Yearbook, 1942, the Boliden Mining Co. was planning to increase its production to 18,000 metric tons of copper annually. Its copper-plant capacity is reported to be 18,000 tons. Production during 1943 was expected to reach between 16,000 and 17,000 tons. This company entered into an operational agreement in regard to three State mines—Adak, Ravliden, and Bjurfors; in addition, it mines copper ore and copper pyrites from the Boliden, Kristineberg, and Laver mines.

Union of South Africa.—The Messina and O'Okiep mines in Northern Transvaal and Namaqualand, respectively, are the chief sources of copper in the Union. Sinclair[8] says that Messina's average annual output is 10,000 tons of ingot copper and that this output probably will rise. Development has shown proved ore reserves of nearly 3,000,000 tons, containing over 2 percent copper. The Namaqualand mines have produced blister copper containing 99.41 percent copper since 1939. A total of about 3,000 tons of ore is treated daily. The article cited states that the production rate at these mines is likely to be increased. Ore reserves of over 10,000,000 tons, with a copper content of over 2 percent, are in sight. As already stated, the copper output is mainly from the Messina and Namaqua fields, but several smaller producers contribute copper, mainly of a byproduct nature. Three producers are gold operations, the Mamre Gold mine of the Eastern Transvaal Consolidated Mines, The Central mines of the Transvaal Gold Mining Estates, and the Rietfontein mine of the Transvaal Consolidated Lands, all operating in Eastern Transvaal. These companies produce by flotation copper-gold concentrates, which are shipped abroad for further reduction. The Rustenburg Platinum Mines, Northern Transvaal, have byproduct output in the form of copper-nickel matte.

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[8] Sinclair, W. E., Copper in South Africa: Min. Mag., vol. 69, No. 2, August 1943, pp. 79–84.

LEAD[1]

By A. L. Ransome and J. H. Schaum

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GENERAL SUMMARY

Lead, although an important member of the nonferrous metal group essential to the war program, did not show to advantage statistically during 1943 in comparison with the record-breaking levels attained by other major metals. Consumption of all lead increased slightly in 1943 owing to partial relaxation of Government conservation and limitation orders, but a marked decrease in refinery production and a decline in imports resulted in an excess of requirements over supply. Consequently the large stock of lead built up by the Government in 1942 from heavy foreign purchases—which reached a maximum by the end of March 1943—was drawn upon to make up the deficit. In recognition of the altered situation, the Conservation Division of the War Production Board reclassified lead on the Materials Substitution and Supply List from group III (available as a substitute) back to group II (sufficient to meet war demands plus controlled essential industrial needs). The prospect for the duration of the war foretells a decreasing supply, which, however, will no doubt be adequate under continued control.

Refined primary lead production from domestic and foreign ores and base bullion decreased 21 percent in 1943; the total from both sources was 116,998 tons less than the 1942 output. Year-end stocks at domestic refineries (physical inventory) declined moderately, but consumers' inventories showed a 32-percent gain which reflects the receipts by consumers of enough foreign lead to raise stocks to a more normal working level.

Total imports of lead in all forms during 1943 declined 35 percent, largely in the category of refined lead, the principal source of which was Mexico. Receipts of lead in base bullion were markedly lower owing to the cessation of shipments from Australia.

The established price of 6.50 cents a pound for lead at New York remained unchanged throughout 1943.

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[1] This report deals primarily with the smelting, refining, and consuming phases of the industry. For full details of mining operations, see separate reports issued for the various States.

Salient statistics of the lead industry in the United States, 1925-29 (average) and 1939-43, in short tons

	1925-29 (average)	1939	1940	1941	1942	1943
Production of refined primary lead:						
From domestic ores and base bullion	660,525	420,967	433,065	470,517	467,367	401,071
From foreign ores and base bullion	123,104	63,068	100,114	100,450	99,472	48,770
	783,629	484,035	533,179	570,967	566,839	449,841
Recovery of secondary lead	280,000	241,500	260,346	397,416	323,001	341,243
Imports:[1]						
Lead in pigs, bars, and old	4,592	7,139	151,568	274,395	369,254	244,510
Lead in base bullion	95,747	48,902	19,624	24,704	43,855	4,583
Lead in ores and matte	40,096	30,842	111,300	82,115	79,362	70,023
Exports of refined pig lead	98,048	74,392	[2] 49,079	14,359	[3] 5,814	[3] 13,261
Lead remaining in bonded warehouse at end of period	136,969	79,215	211,876	156,286	(4)	(4)
Refined primary lead apparently shipped to domestic consumers	690,916	415,031	633,989	812,863	670,840	757,890
Estimated consumption of primary and and secondary lead	900,250	667,000	782,000	1,050,000	1,043,000	1,113,000
Prices:						
New York:						
Average for year..cents per pound	7.47	5.05	5.18	5.79	6.48	6.50
Quotation at end of year....do	6.25	5.50	5.50	5.85	6.50	6.50
London average....do	5.87	[5] 3.09	(6)	(6)	(6)	(6)
Mine production of recoverable lead	664,230	413,979	457,392	461,426	496,289	453,313
World smelter production of lead	1,850,000	1,911,000	(4)	(4)	(4)	(4)

[1] Data include lead imported for immediate consumption plus material entering the country under bond.

[2] Includes 25,324 tons of foreign refined lead reexported, according to American Bureau of Metal Statistics; official figures not available.

[3] Includes 3,874 tons of foreign lead reexported in 1942 and 11,258 tons in 1943, according to records of the U. S Department of Commerce.

[4] Data not available.

[5] Average for 8 months; London Metal Exchange dealings suspended for duration of war.

[6] Official maximum price fixed by British Ministry of Supply at £25 per long ton.

Figure 1 shows trends in the domestic lead industry since 1900.

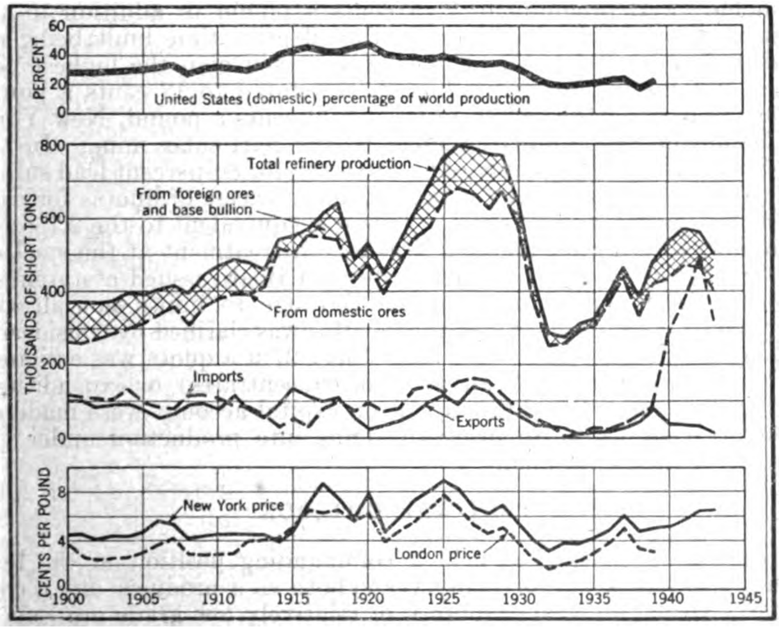

FIGURE 1.—Trends in the lead industry in the United States, 1900–1943. Imports include lead in ore, base bullion, pig lead, and scrap; exports include pigs, bars, and scrap lead exported in manufactures with benefit of draw-back. Data on lead exported in manufactures with benefit of draw-back not available for 1943.

WAR AGENCY REGULATIONS

Lead remained under Government control throughout 1943, according to General Preference Order M-38, which provides for the regulation of shipments, deliveries, and a reserve pool for allocation. The original Order M-38, announced in October 1941 and later extended beyond the March (1942) termination date, included supplemental orders M-38-a through j; the last was revoked July 4, 1942. Since the beginning of 1943 four amendments to Order M-38 have been issued, dated January 1, February 2, May 26, and December 24, 1943; all have progressively liberalized the restrictions on the use of lead. Originally the uses of lead, under Conservation Order M-38-c, were divided into three classes—a prohibited list, an unlimited list, and all other uses to be limited in 1942 to 90 percent of consumption in the corresponding quarter of 1941. In the new Order M-38, as amended December 24, 1943, the list of prohibited uses has been retained with some changes, but the essential uses have been freed from all control.

Limitation Order L-180, affecting storage batteries, was amended January 5, 1943, to allow greater use of available antimonial lead and was again amended on January 22, 1944. Similarly Limitation Order L-64 was amended on March 16, 1944, to permit the use of more lead in the manufacture of caskets.

The premium-price plan, whereby producers (miners) of lead (copper and zinc were also included in the plan) receive additional increments above the ceiling price (through Metals Reserve Co.) for overquota production, was maintained throughout 1943. On February 18, 1943, the scope of the Metals Reserve Co. plan was broadened to include a B premium of 2.75 cents a pound in addition to the existing A premium of 2.75 cents, the effective time limit being extended to July 31, 1945. Under this revised plan the highest possible payment for excess production amounted to 12 cents a pound upon the basis of the ceiling price of 6.50 cents a pound, New York, depending on the quotas assigned to the particular mine. In the Tri-State district a premium of $41.80 a ton for 80-percent lead sulfide concentrates was payable for production in excess of quotas for each of the assigned A and B levels. This was equivalent to the 2.75-cent premium, allowing for metallurgical loss in treatment at the smelter. On October 27, 1943, the War Production Board issued a statement denying the premium price in the B range to mines not already operating on that date. Subsequently this was clarified by considering a mine as "already operating" on October 27 if a quota was assigned, the mine shipped metal (lead in ore or concentrates), or expenditures for development, reconditioning, or on capital account were made on or before October 27 to bring the mine into production under the benefits of the quota plan.

POST-WAR OUTLOOK

The United States has held a commanding position in the lead industry of the world for many years, both as a producer and a consumer. Owing to vast resources of relatively low grade ore—made available largely by creating a domestic price based upon a tariff—production from domestic sources supplied nearly the entire domestic demand for primary lead until the advent of the Second World War late in 1939. The subsequent sharp rise in consumption of lead metal and lead in ore for pigments, which reached a peak in 1941, completely overshadowed production from domestic mines, and the balance of necessity had to come from greatly expanded imports, largely in refined form from Mexico. The great influx of foreign lead, for the most part held in Government stock piles in reserve, made unnecessary any greater demand upon domestic lead producers—particularly when all possible supply of labor was being diverted to the mining of more critical metals. Government control of lead consumption, the incentive of premium payments to producers for increased output, and the expanded flow of foreign lead thus has generally kept supply and requirements in rough balance. The pent-up consumer demand to be filled in the post-war years in all probability will result in an annual consumption of lead as metal and in ore of at least 500,000 tons—probably more—for some years, not including the quantity needed for possible Government stock piles now being considered and the lead recovered from secondary sources.

The answers to the questions of the future of Government control and prices cannot be foretold. It is possible that there will be limited control to bridge the gap of industrial reconversion from a war to a peacetime economy and probable that the price of lead will drop. The domestic mines could conceivably fill the demand for new lead for a limited time, given adequate price and tariff protection, but ore reserves have been drawn upon heavily during the war years, and the past partial dependence on foreign lead doubtless will continue in increasing amounts as our resources are drained further.

DOMESTIC PRODUCTION

Pig lead is produced at primary plants that treat ore, base bullion, and small quantities of scrap and at secondary plants that process scrap exclusively. Both types of plants may make refined lead or antimonial lead. Because of the large quantity of hard lead, such as battery scrap melted at secondary smelters, their output is essentially antimonial lead alloys. Figures for the production of refined lead and alloys at secondary plants are given in the section on Secondary Lead. The 16 smelters and refiners in the United States canvassed in 1943 consumed 500,197 short tons (lead content) of ore, only 14 percent of which originated in foreign countries.

REFINED LEAD

Curtailed by labor shortages, scarcity of materials, and smaller imports of ore and base bullion the 10 primary refineries produced only 471,475 tons of refined lead, 19 percent below the 1942 output of 579,695 tons.

Of the 449,841 tons of primary refined lead produced in 1943, 89 percent was derived from domestic ores and base bullion and 11 percent from foreign. In 1942 the origin was 82 percent domestic and 18 percent foreign. Virtually no refined lead was produced from foreign base bullion in 1943. The marked drop from 1942 was due largely to Mexican base bullion being refined in Mexico, plus a lack of Australian material. Australian output was lowered in favor of increased copper and zinc production, and reduced shipments of base bullion were directed to Great Britain. The following table gives the production of refined lead by country of origin of the ore. Details of the sources of lead from domestic ores are given in the section on Mine Production.

Refined lead produced at primary refineries in the United States, by sources, 1939–43, in short tons

Source	1939	1940	1941	1942	1943
Refined lead:					
From domestic ores and base bullion	420,967	433,065	470,517	467,367	401,071
From foreign ores	24,652	83,563	74,166	81,485	48,628
From foreign base bullion	38,416	16,551	26,284	17,987	142
Total from primary sources	484,035	533,179	570,967	566,839	449,841
From scrap	29,011	16,588	13,454	12,856	21,634
Total refined lead	513,046	549,767	584,421	579,695	471,475
Average sales price per pound	$0.047	$0.050	$0.057	$0.063	$0.064
Total calculated values of primary refined lead [1]	$45,499,000	$53,318,000	$65,090,000	$71,422,000	$60,349,000

[1] Excludes value of refined lead produced from scrap at primary refineries.

Refined primary lead produced in the United States, by country of origin, 1939–43, in short tons

Source	1939	1940	1941	1942	1943
Domestic ore and base bullion	420,967	433,065	470,517	467,367	401,071
Foreign ore:					
Australia	7,580	14,856	19,561	19,638	12,643
Canada	4,763	9,009	5,708	5,980	3,404
Europe	188	3,650	123	14	
Mexico	227	1,303	390	2,403	1,945
South America	8,869	34,744	27,173	23,127	7,294
Other foreign	3,025	20,001	21,211	30,323	23,342
	24,652	83,563	74,166	81,485	48,628
Foreign base bullion:					
Australia			831	16,902	
Mexico	37,463	16,161	25,358	111	57
South America	9		47	216	85
Other foreign	944	390	48	758	
	38,416	16,551	26,284	17,987	142
Total foreign	63,068	100,114	100,450	99,472	48,770
Grand total	484,035	533,179	570,967	566,839	449,841

ANTIMONIAL LEAD

Antimonial lead production at primary refineries increased 23 percent to 63,515 tons in 1943. The distribution of the lead, according to source, is shown in the following table. The antimony content continued to decrease, largely because of the increased quantity of low antimonial lead produced for bullet core rod. In addition to this antimonial lead produced as a byproduct in the refining of base bullion, a much larger quantity was obtained from the smelting of antimonial lead scrap at secondary smelters. Production data from lead-smelting plants handling scrap materials exclusively are summarized in the following section and discussed in detail in the chapter on Secondary Metals—Nonferrous.

Antimonial lead produced at primary lead refineries in the United States, 1939–43

Year	Production (short tons)	Antimony content		Lead content by difference (short tons)			
		Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
1939	21,995	2,031	9.2	4,117	3,189	12,658	19,964
1940	29,762	2,944	9.9	7,364	3,023	16,431	26,818
1941	40,237	3,510	8.7	14,852	8,013	13,862	36,727
1942	51,762	3,524	6.8	24,512	12,165	11,561	48,238
1943	63,515	3,371	5.3	36,057	17,365	6,722	60,144

SECONDARY LEAD

Although some scrap lead is treated at primary plants, the major part is received at a large number of establishments that handle secondary materials exclusively. Secondary lead is recovered in the form of refined lead, antimonial lead, and other alloys. Secondary lead recovered in 1943 totaled 341,243 tons, 6 percent more than in 1942. The secondary refined-lead production of 58,322 tons comprised 11 percent of the total refined output, and the 176,076 tons of secondary recovered in antimonial lead represented 77 percent of the total. Further details appear in the chapter on Secondary Metals—Nonferrous.

Secondary lead recovered in the United States, 1942–43, in short tons

	1942	1943
As refined metal:		
At primary plants	12,856	21,634
At other plants	55,746	36,688
	68,602	58,322
In antimonial lead:		
At primary plants	11,561	6,722
At other plants	158,998	169,354
	170,559	176,076
In other alloys	83,840	106,845
Grand total:		
Short tons	323,001	341,243
Value	$40,698,100	$43,679,100

LEAD PIGMENTS

The principal lead pigments are litharge, white lead, red lead, sublimed lead, leaded zinc oxide, and orange mineral. These products are manufactured for the most part from lead ore and metal. Details of the production of lead pigments and salts are given in the chapter on Lead and Zinc Pigments and Zinc Salts.

MINE PRODUCTION

The mine production of recoverable lead (including that made into lead pigments) in the United States and Alaska decreased 9 percent in 1943. Of the 23 States and Alaska where lead is produced, 17 States and Alaska showed a decline. This general drop in output was due to several reasons, including exhaustion of developed ore reserves, manpower shortages, and inefficiency of available replacements for miners taken into the armed forces and those who left for higher-paying jobs in war plants.

Mine production of recoverable lead in the United States, 1925–29 (average) and 1939–43, by States, in short tons

State	1925–29 (average)	1939	1940	1941	1942	1943
Western States and Alaska:						
Alaska	982	937	779	662	415	200
Arizona	9,743	10,771	13,266	15,638	14,772	13,727
California	2,070	526	1,772	3,464	5,151	5,820
Colorado	30,112	8,222	11,476	12,574	15,181	18,032
Idaho	141,610	90,981	104,834	104,914	113,909	96,157
Montana	18,871	16,555	23,036	21,259	20,050	16,324
Nevada	9,807	4,236	7,499	9,623	5,376	4,790
New Mexico	6,730	5,392	3,822	4,668	4,608	5,723
Oregon	6	15	35	59	23	4
South Dakota	21	---------	7	---------	85	41
Texas	213	227	205	186	181	13
Utah	149,509	67,634	75,688	69,601	71,930	65,257
Washington	1,323	3,718	2,555	3,903	4,851	5,022
Wyoming	---------	---------	---------	---------	3	---------
	370,997	209,214	244,974	246,551	256,535	231,410
Central States:						
Arkansas	38	---------	55	11	2	1
Illinois	552	308	1,508	2,376	2,344	2,043
Kansas	26,121	13,697	11,927	14,538	9,419	9,213
Kentucky	135	87	360	282	335	240
Missouri	202,240	156,281	172,052	165,909	199,548	184,910
Oklahoma	58,306	27,720	21,240	25,021	22,806	19,733
Wisconsin	1,745	388	445	1,225	775	920
	289,137	198,481	207.587	209,362	235,229	217,060
Eastern States:						
New York	---------	2,387	1,973	2,100	2,434	2,355
Tennessee	250	517	573	23	238	200
Virginia	3,846	3,380	2,285	3,390	1,803	2,288
	4,096	6,284	4,831	5,513	4,475	4,843
	664,230	413,979	457,392	461,426	496,239	453,313

Lead mining is largely centered in three areas—Southeastern Missouri, the Tri-State area, and the Western States (principally Idaho, Utah, Colorado, Montana, and Arizona). The Eastern States supply only a minor proportion of the total. Although output of lead from Southeastern Missouri decreased 18,279 tons in 1943, this district continued to be the largest lead-producing area in the United States and supplied 39 percent of the total domestic production. The Tri-State area (Joplin region), the principal zinc-producing area in the United States, furnished 8 percent of the total United States output and contributed 381 tons more than in 1942 despite the severe floods late in May, which caused the temporary shut-down of many mines in that area. Idaho continued to be the leading producer among the Western States, notwithstanding a decline of 15 percent. Of Idaho's total lead output, the greater part came from zinc-lead ore and old tailings and the remainder largely from lead ore. Utah ranked second among the Western States and third in the United States in lead production, with an output of 65,257 tons of recoverable lead, which was 9 percent less than in 1942. Other principal producing States, in order of productivity, were Colorado, Montana, and Arizona.

Mine production of recoverable lead in the United States, by districts that produced 1,000 tons or more during any year from 1939 to 1943, in short tons

District	State	1939	1940	1941	1942	1943
Southeastern Missouri region	Missouri	153, 522	169, 893	164, 342	197, 291	179, 012
Coeur d'Alene region	Idaho	81, 699	95, 609	95, 529	106, 474	89, 813
Bingham	Utah	36, 842	37, 857	34, 512	39, 996	35, 437
Joplin region	Kansas, Southwestern Missouri, Oklahoma.	44, 176	35, 311	41, 080	34, 341	34, 722
Park City region	Utah	11, 631	19, 749	19, 094	15, 278	16, 022
Tintic	do	8, 618	6, 536	9, 424	10, 176	8, 261
Leadville	Colorado	1, 088	794	1, 112	3, 348	4, 950
Metaline	Washington	3, 509	2, 495	3, 819	4, 553	4, 581
Warm Springs	Idaho	5, 565	5, 050	5, 334	3, 783	3, 635
Central	New Mexico	2, 941	3, 245	3, 902	3, 206	3, 571
Rush Valley	Utah	3, 422	4, 760	4, 168	3, 988	3, 505
Harshaw	Arizona	2, 287	4, 581	5, 541	6, 132	3, 496
Butte	Montana	4, 708	8, 859	8, 630	7, 206	3, 290
Old Hat	Arizona	1, 861	1, 908	2, 172	1, 801	3, 140
Pioche	Nevada	2, 964	5, 520	6, 822	2, 764	2, 942
Resting Springs	California	....	870	2, 581	4, 044	2, 938
Animas	Colorado	958	2, 471	3, 045	2, 124	2, 657
Pioneer (Rico)	do	752	1, 928	2, 525	2, 282	2, 566
Coso	California	....	....	....	....	2, 448
Smelter	Montana	1, 256	1, 363	1, 527	1, 988	2, 389
St. Lawrence County	New York	2, 387	1, 973	2, 100	2, 434	2, 355
Heddleston	Montana	7	50	967	2, 290	2, 350
Kentucky, Southern Illinois	Kentucky, Southern Illinois	395	1, 860	2, 538	2, 546	2, 199
Upper San Miguel	Colorado	1, 489	1, 278	1, 408	1, 716	2, 074
Red Cliff	do	1, 137	1, 412	1, 710	2, 240	1, 761
Austinville	Virginia	3, 380	[1] 2, 285	3, 390	1, 661	1, 760
Barker	Montana	780	131	22	1, 704	1, 609
Eagle	do	3, 252	4, 108	3, 294	1, 999	1, 580
Bayhorse	Idaho	999	935	1, 378	1, 644	1, 481
Ophir	Utah	6, 050	5, 354	1, 437	1, 623	1, 461
Wallapai	Arizona	703	2, 304	2, 408	1, 656	1, 392
Magdalena	New Mexico	91	65	424	864	1, 320
Big Bug	Arizona	542	690	594	953	1, 145
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	388	453	1, 345	908	1, 004
Montana	Montana	293	955	1, 601	1, 025	509
Port Hill	Idaho	1, 111	1, 837	1, 537	1, 044	316
Cataract	Montana	1, 672	1, 904	355	26	115
Willow Creek	New Mexico	1, 800	....	....	....	29
Hog Heaven	Montana	2, 767	3, 588	2, 824	614	....
Oro Blanco	Arizona	3, 568	....	1	6	....

[1] Total for Virginia but almost entirely from Austinville district.

STOCKS

Producers' stocks.—Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by most refiners of secondary material who produce common soft lead as well as foreign lead refined in the United States and entered

Lead stocks at end of year at smelters and refineries in the United States, 1939–43, in short tons

	1939	1940	1941	1942	1943
Refined pig lead	52, 783	32, 458	15, 973	28, 815	28, 821
Antimonial lead	5, 994	8, 468	4, 212	6, 122	4, 269
	58, 777	40, 926	20, 185	34, 937	33, 090
Lead in base bullion—					
At smelters and refineries	10, 337	9, 166	8, 594	7, 359	8, 640
In transit to refineries	3, 521	3, 457	2, 215	1, 706	3, 112
In process at refineries	15, 958	18, 141	17, 709	13, 925	16, 020
	29, 816	30, 764	28, 518	22, 990	27, 772
Lead in ore and matte and in process at smelters	59, 486	71, 722	51, 446	59, 247	68, 678
	148, 079	143, 412	100, 149	117, 174	129, 540

for domestic consumption. Stocks of refined lead and antimonial lead fluctuated erratically from 34,937 tons at the beginning of the year to a high of 38,132 tons at the end of February, and a low of 20,438 tons at the end of June and closed 1943 with 27,996 tons on hand, a net decrease of 20 percent during the year.

The Bureau of Mines survey of primary smelters and refiners in 1943 asked for data on stocks at plants for the first time. The results of this survey showed stocks of refined lead amounting to 39,255 tons (lead content) at plants on January 1, 1943, and 36,464 tons on December 31, 1943. At these same plants primary antimonial lead stocks dropped from 4,631 tons (lead content) to 3,682 tons during 1943. In terms of lead content, stocks of ore at the 16 operating smelters and refineries increased 29 percent from 39,438 to 50,927 tons during the same period. The inventory of base bullion, at smelters only, totaled 6,323 tons at the beginning of January and 8,096 tons at the end of December. No direct correlation can be made between these data and the figures of the American Bureau of Metal Statistics. Figures reported to the Bureau of Mines represent physical inventory at the plants, irrespective of ownership, and do not include material in process or "in transit."

Consumers' stocks.—Approximately 430 consumer plants reported stocks of 108,012 tons of domestic and foreign refined lead on hand December 31, 1943, 32 percent greater than the 81,660-ton inventory held at the end of 1942.

Consumers' stocks of refined soft lead at the end of 1942 and 1943, by grades, in short tons

	Domestic and foreign					Foreign (all grades)
	Corroding	Chemical	Common	Other	Total	
Dec. 31, 1942 [1]	23,113	18,383	37,476	2,688	81,660	6,203
Dec. 31, 1943	23,921	18,706	60,873	4,512	108,012	12,706

[1] Revised figures.

Government stocks.—Industry-owned stocks were augmented by large quantities of lead bought by the Metals Reserve Co. (official Government purchasing agency) and stock-piled for emergency uses. According to reports submitted to the Tin-Lead Division of the War Production Board, Government stocks totaled 173,875 tons of refined lead and 3,267 tons of lead in ore and concentrates on December 31, 1943, compared with 248,361 tons of refined lead and no ore and concentrates held on January 1, 1943.

DOMESTIC CONSUMPTION

A survey of approximately 430 plants in 1943 representing 90 percent of the consumers of refined lead showed a total consumption of 675,465 short tons of refined lead, a gain of 11 percent over 1942. Secondary as well as primary refined lead is included in this figure. Antimonial lead, unrefined scrap lead, and lead in alloys are excluded.

Of the total consumed, 18 percent was used to make red lead and litharge, 17 percent for cable covering, 10 percent for storage batteries, 10 percent for tetraethyl, 9 percent for ammunition, and the remaining 36 percent for a variety of products shown in the accompanying table.

Consumption of refined lead in the United States, 1941–43, by uses, in short tons

	1941	1942 [1]	1943
Ammunition	32,959	48,025	64,023
Bearing metals	10,160	8,466	10,189
Brass and bronze	(2)	5,294	5,748
Cable covering	141,161	128,535	117,802
Calking lead	32,380	9,047	8,618
Casting metals	9,243	3,106	3,072
Collapsible tubes	3,726	9,966	11,425
Foil	51,516	9,359	5,816
Pipe, traps, and bends	32,946	21,411	18,724
Sheet lead	35,480	31,700	27,738
Solder	35,630	13,371	15,472
Storage batteries	73,982	62,604	68,239
Terne plate	2,069	2,336	815
Type metals	2,975	943	812
White lead	83,230	56,476	36,809
Red lead and litharge	143,496	100,563	124,715
Tetraethyl lead	48,327	50,152	65,320
Chemicals and insecticides	8,861	6,298	8,172
Annealing	(2)	5,229	5,987
Galvanizing	(2)	484	819
Lead plating	(2)	(2)	941
Weights and ballast	(2)	(2)	9,269
Other	64,506	33,746	64,940
Total	812,647	607,111	675,465

[1] Revised figures.
[2] Included in "Other."

A distribution by related uses shows 61 percent consumed for metallic products, 25 percent for pigments, 11 percent in chemical products, and 3 percent in miscellaneous uses, such as annealing, galvanizing, lead plating, weights, and ballast. Owing to the demand characteristics of the war, major gains were made in the use of lead for ammunition, red lead and litharge, tetraethyl, and galvanizing, with minor increases for bearing metals, brass and bronze, collapsible tubes, solder, storage batteries, chemicals and insecticides, and annealing.

Reports to the Tin-Lead Division of the War Production Board indicate that the consumption of primary, antimonial, and secondary lead totaled 1,113,000 tons in 1943 compared with 1,043,000 tons in 1942.

The following table has been constructed to calculate apparent

Apparent shipments of refined primary pig lead to domestic consumers, 1939–43, in short tons

	1939	1940	1941	1942	1943
Supply:					
Stocks at primary refineries on Jan. 1	(1)	(1)	(1)	[2] 12,000	39,255
Government-owned stocks on Jan. 1 [3]				17,934	248,361
Production	484,035	533,179	570,967	566,839	449,841
Imports	5,388	149,889	274,189	366,497	244,033
Total available	489,423	683,068	845,156	963,270	981,490
Withdrawn:					
Stocks at primary refineries on Dec. 31	(1)	(1)	(1)	39,255	36,464
Government-owned stocks on Dec. 31 [3]			17,934	248,361	173,875
Exports	74,392	[4] 49,079	14,359	[5] 5,814	[5] 13,261
Total withdrawn	74,392	49,079	32,293	293,430	223,600
Apparent shipments to domestic consumers	415,031	633,989	812,863	669,840	757,890

[1] Official figures not available.
[2] Estimate based upon American Bureau of Metal Statistics data.
[3] According to reports submitted to the Tin-Lead Division of the War Production Board.
[4] Includes 25,324 tons of foreign refined lead reexported, according to American Bureau of Metal Statistics, official figures not available.
[5] Includes 3,874 tons of foreign refined lead reexported in 1942 and 11,258 tons in 1943, according to U. S. Department of Commerce.

shipments to domestic consumers by adding primary production, net changes in stocks, and excess of imports over exports. The apparent shipments of 757,890 tons are probably more nearly correct than the actual receipts of 701,817 tons reported by the consumer plants, because of incomplete coverage in the survey.

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced in this country is sold at prices normally based upon quotations in these markets. Since suspension of the London Metal Exchange dealings in September 1939 for the duration of the war the London market has had no actual influence on New York quotations, and the differential between St. Louis and New York prices has remained at 0.15 cent a pound, an amount approximating the freight charges between the two points.

The ceiling price for common lead—6.35 cents a pound, St. Louis, and 6.50 cents, New York—remained unchanged throughout 1943. For comparison it is interesting to note that the average price received by the primary producers for all grades of lead sold in 1943 was 6.4 cents a pound, f. o. b. plant (6.3 cents in 1942). The 1943 price of 7.5 cents for lead, which appears in the separate State chapters, represents the above weighted average price received for refined lead plus the increment—in terms of cents per pound based upon the total recoverable lead output—of $10,200,000 in overquota premiums paid by the Metals Reserve Co. A brief outline of the 1943 developments of the premium-price plan is given in this chapter under the heading, War Agency Regulations.

The official London maximum price of £25 per long ton, duty paid, for Empire and foreign lead, remained unchanged during 1943.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1941–43, in cents per pound [1]

Month	1941			1942			1943		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	5.35	5.50	(2)	6.12	6.27	(2)	6.35	6.50	(2)
February	5.45	5.60		6.35	6.50		6.35	6.50	
March	5.61	5.77		6.35	6.50		6.35	6.50	
April	5.70	5.85		6.35	6.50		6.35	6.50	
May	5.70	5.85		6.35	6.50		6.35	6.50	
June	5.70	5.85		6.35	6.50		6.35	6.50	
July	5.70	5.85		6.35	6.50		6.35	6.50	
August	5.70	5.85		6.35	6.50		6.35	6.50	
September	5.70	5.85		6.35	6.50		6.35	6.50	
October	5.70	5.85		6.35	6.50		6.35	6.50	
November	5.70	5.85		6.35	6.50		6.35	6.50	
December	5.70	5.85		6.35	6.50		6.35	6.50	
Average	5.64	5.79	(2)	6.33	6.48	(2)	6.35	6.50	(2)

[1] St. Louis: Metal Statistics, 1944, p. 477. New York: Metal Statistics, 1944, p. 471.

[2] London Metal Exchange dealings suspended for duration of war. Official maximum price fixed by British Ministry of Supply at £25 in December 1939.

FOREIGN TRADE [2]

During 1943 imports of lead continued at a high rate but not to the extent of the record receipts of 1942. A substantial part of the total pig lead imported in 1942 came from Australia and Canada under Metals Reserve Co. contracts. The termination of these contracts resulted in cessation of imports early in 1943, and none is now available from these countries. The significant feature of the decline in total imports—the first break in the upward trend since 1936—was the resultant lowering of the available new supply below the level necessary to meet requirements, with consequent greater drain upon Government stocks of refined lead. The great dependence of our wartime program on imported lead is demonstrated by the fact that lowered imports to a large extent were responsible for returning lead to group II of the Materials Substitution and Supply List from the group III position it held in 1942, when it was available for essential needs and as a substitute metal.

Imports.—Total imports of lead in 1943 were 35 percent less than in 1942, largely because of a decline in imports of pig lead amounting to 34 percent. Receipts of lead in ore and matte, which constituted 22 percent of the total, were 12 percent under 1942, and imports of lead in base bullion were only about one-tenth as large as last year. In the refined-lead category, Mexico furnished 87 percent, Peru 8 percent, Australia between 3 and 4 percent, and Canada less than 1 percent, compared with 52, 6, 23, and 19 percent, respectively, in 1942. Nearly all imports of base bullion (84 percent) came from Australia (98 percent in 1942) during January and February. Almost the entire amount remains in stock and has yet to appear as refined metal from this source. As in 1942, lead in ore and matte came from numerous sources; the principal countries of origin were Australia, Africa, and Newfoundland, which together furnished 71 percent of the total imports of this material.

Total lead imported into the United States, 1939–43, by forms in which imported, in short tons [1]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, and old	Total lead content
1939	30, 842	48, 902	7, 139	86, 883
1940	111, 300	19, 624	151, 568	282, 492
1941	82, 115	24, 704	274, 395	381, 214
1942	79, 362	43, 855	369, 254	492, 471
1943	70, 023	4, 583	244, 510	319, 116

[1] Data include lead imported for immediate consumption plus material entering country under bond.

Total lead imported into the United States, in ore, base bullion, and refined, 1939–43, by countries, in short tons [1]

Year	Canada	Mexico	New-foundland	South America [2]	Europe	Other countries	Total
1939	5, 641	52, 059	1	16, 527	1, 971	10, 684	86, 883
1940	8, 721	149, 493	27, 563	63, 120	3, 891	29, 704	282, 492
1941	95, 686	129, 446	17, 569	69, 826	175	68, 512	381, 214
1942	78, 109	194, 458	23, 951	42, 262	----------	153, 691	492, 471
1943	8, 337	217, 294	13, 473	30, 858	----------	49, 154	319, 116

[1] Data include lead imported for immediate consumption plus material entering country under bond.

[2] Includes imports from Argentina as follows—1938: 4 tons; 1939: 3,362 tons; 1940: 16,469 tons; 1941: 13,374 tons; and 1942: 4,582 tons. None reported in 1943.

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[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and old, 1939–43, by countries, in short tons[1]

Country	1939	1940	1941	1942	1943
In ore and matte:					
Africa	7	7, 586	575	3, 879	16, 438
Argentina	3, 362	16, 469	13, 374	4, 582	
Australia	7, 612	17, 472	22, 634	20, 997	19, 743
Bolivia	7	2, 707	7, 314	1, 382	7, 012
Canada	5, 624	8, 666	5, 725	7, 487	6, 828
Chile	1, 844	6, 271	1, 384	3, 166	
Mexico	3, 846	1, 804	5, 770	2, 358	2, 931
Newfoundland		27, 563	17, 569	23, 951	13, 473
Peru	7, 174	18, 383	6, 665	11, 168	3, 436
United Kingdom[2]	1, 058	3, 498	175		
Other countries	308	881	930	392	172
	30, 842	111, 300	82, 115	79, 362	70, 023
In base bullion:					
Australia			835	42, 900	3, 846
Mexico	47, 915	19, 009	23, 726	56	639
Peru	84	179	58	16	94
Other countries	903	436	85	883	4
	48, 902	19, 624	24, 704	43, 855	4, 583
In pigs, bars, and old:					
Australia	2, 727	4, 266	43, 631	84, 748	8, 994
Canada	17	55	89, 887	70, 502	1, 505
Mexico	298	128, 680	99, 950	192, 044	213, 724
Peru	4, 051	18, 452	40, 868	21, 948	20, 158
Other countries	46	115	59	12	129
	7, 139	151, 568	274, 395	369, 254	244, 510
	86, 883	282, 492	381, 214	492, 471	319, 116

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] United Kingdom of Great Britain and Northern Ireland.

Lead[1] *imported for consumption in the United States, 1939–43, by forms in which imported*

Year	Lead in ores, flue dust, and mattes n. s. p. f.		Lead in base bullion		Pigs and bars		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1939	12, 317	$1, 063, 512	1, 764	$166, 298	4, 772	$176, 437	170	$28, 296	$11, 611	$1, 449, 541
1940	70, 027	4, 659, 445	9, 992	929, 946	36, 882	2, 269, 075	201	36, 444	12, 046	7, 910, 873
1941	82, 345	5, 343, 577	17, 579	1, 743, 350	325, 999	23, 403, 260	47	15, 812	19, 389	30, 582, 741
1942	87, 377	5, 715, 251	48, 589	4, 285, 425	387, 693	32, 328, 330	20	7, 009	4, 690	42, 478, 098
1943	82, 212	5, 467, 211	4, 511	557, 545	244, 033	20, 900, 607	25	20, 208	5, 219	27, 006, 948

[1] In addition to quantities shown (values included in total values), "reclaimed, scrap, etc.," imported as follows—1939: 26 tons, $3,387; 1940: 24 tons, $3,917; 1941: 1,331 tons, $57,353; 1942: 1,305 tons, $137,393; and 1943: 496 tons, $56,158. Figures for 1942 and 1943 include foreign lead received by the Government and held in stock piles.

Miscellaneous products, containing lead, imported for consumption in the United States, 1939–43

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1939	136	45	$96, 492	380	321	$38, 491
1940	1, 368	429	1, 026, 432	1, 482	1, 291	108, 286
1941	702	241	711, 388	1, 657	1, 454	112, 120
1942	971	274	66, 096	245	210	19, 631
1943	236	69	330, 824	3, 703	3, 422	447, 019

Exports.—Under the restrictions of the Export Control Act of 1940, exports of pig lead in 1943 (excluding reexports of foreign refined lead) continued to be minor. Of the 2,003 tons shipped 90 percent was destined for the United Kingdom and Brazil.

Lead exported from the United States, 1939–43

Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)
	Short tons	Value			Short tons	Value	
1939	74,392	$4,547,219	10,379	1942	1,940	$285,354	26,248
1940	23,755	1,794,590	15,604	1943	2,003	244,433	(1)
1941	14,359	1,159,148	21,953				

[1] Data not available.

Pig lead exported from the United States, 1939–43, by destinations, in short tons

Destination	1939	1940[1]	1941	1942[2]	1943[2]
Countries:					
Belgium	588	644			
Brazil	647	1,559	764	51	779
Canada	5	34	12	1	9
Chile	323	492	822	18	7
China	224	517	2,335		
Denmark	1,569				
Finland	616	112			
France	540	1,120			
Germany	8,333				
Hungary	560	437			
Japan	34,790	11,958	8,154		
Kwantung	99	336			
Mexico	2,922	15	14	7	5
Netherlands	2,101	2,352			
Norway	1,091				
Panama	238	538	379	74	8
Philippine Islands	974	450	628		
Sweden	7,340	301	112	224	
United Kingdom[3]	9,411	2		1,379	1,017
Uruguay		350	407		
Other countries	2,021	2,538	732	186	178
	74,392	23,755	14,359	1,940	2,003
Continents:					
North America	3,345	865	574	135	80
South America	1,317	3,078	2,334	190	883
Europe	33,152	6,400	228	1,609	1,031
Asia	36,122	13,384	11,132	4	6
Africa and Oceania	456	28	91	2	3

[1] In addition, 25,324 tons of foreign lead were reexported, according to American Bureau of Metal Statistics; official figures not available.

[2] In addition, 3,874 tons of foreign lead were reexported in 1942 and 11,258 tons in 1943, according to records of the Department of Commerce.

[3] United Kingdom of Great Britain and Northern Ireland.

WORLD ASPECTS OF THE LEAD INDUSTRY

Although considerable information is available for 1943 with respect to wartime developments in lead, these data are for the most part confined to countries in the Western Hemisphere. The continued dearth of pertinent information from many other important lead-producing centers makes any estimates of world production and consumption unwarranted. The last estimate by the Bureau of Mines indicated a world mine production of 1,635,000 metric tons in 1942, and it is doubtful if the output for 1943 was any greater, if as much. Increased Mexican output was insufficient to balance a lower production from both Canada and the United States, most South American countries showed a decline, and Australian production probably was less than in 1942. It is assumed that, under war conditions prevailing in Europe during 1943, production could not have advanced in those countries. In general, the lead position of the United Nations was relatively easy in 1943, and although consumption probably increased somewhat the total was roughly in balance with the supply.

World production of lead, 1938–43, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Argentina	10,200	14,000	12,864	18,021	20,760	22,724
Australia	226,155	269,590	275,000	(2)	(2)	(2)
Belgium	94,170	82,000	[3] 55,000	[3] 20,000	(2)	(2)
Burma	80,166	77,220	[3] 83,000	(2)	(2)	(2)
Canada	181,783	172,880	199,662	201,976	220,726	203,095
China	[3] 2,000	(4)	(2)	(2)	(2)	(2)
Chosen	[3] 10,000	(4)	(2)	(2)	(2)	(2)
Czechoslovakia	[3] 5,000	(4)	(2)	(2)	(2)	(2)
France	41,753	42,000	[3] 20,000	[3] 10,000	(2)	(2)
Germany [5]	171,700	181,440	[3] 200,000	[3] 225,000	(2)	(2)
Austria	9,280					
Greece	6,050	4,925	(2)	(2)	(2)	(2)
Hungary	[3] 150	(4)	(2)	(2)	(2)	(2)
Indochina	10	5	(2)	(2)	(2)	(2)
Italy	43,287	38,102	[3] 35,000	(2)	(2)	(2)
Japan	[3] 12,000	[3] 12,000	[3] 15,000	[3] 17,000	(2)	(2)
Mexico	[6] 273,529	213,675	191,980	151,167	[6] 198,023	[6] 218,126
Northern Rhodesia	277	163	293	378	(2)	(2)
Norway	323	321	(2)	(2)	(2)	(2)
Peru	28,478	24,310	31,131	34,375	42,246	[3] 43,171
Poland	19,973	(4)	[3] 23,000	[3] 25,000	(2)	(2)
Rumania	5,655	5,100	(2)	(2)	(2)	(2)
South-West Africa	3,214	4,283	690	----------	(2)	(2)
Spain	31,809	25,991	45,991	46,865	(2)	[3] 34,000
Tunisia	23,916	23,421	(2)	(2)	(2)	(2)
Union of South Africa	19	11	(2)	(2)	(2)	(2)
U. S. S. R.	[3] 69,000	(4)	[3] 75,000	(2)	(2)	(2)
United Kingdom	10,000	(4)	(2)	(2)	(2)	(2)
United States (refined) [7]	330,963	404,257	468,675	494,126	497,908	407,958
Yugoslavia	8,646	10,652	(2)	(2)	(2)	(2)
	1,700,000	1,734,000	(2)	(2)	(2)	(2)

[1] By countries where smelted, but not necessarily refined.

[2] Data not yet available.

[3] Approximate production.

[4] Estimate included in total.

[5] Exclusive of secondary material (Metallgesellschaft, Frankfort on the Main).

[6] Includes small tonnage of lead contained in exported ore and concentrates. Separate figures not available.

[7] Figures cover lead refined from domestic and foreign ores; refined lead produced from foreign base bullion not included.

REVIEW BY COUNTRIES

Argentina.—During 1943 the production of lead was generally limited to the amount necessary to meet Argentina's own needs—6,000 to 7,000 metric tons a quarter. The Metals Reserve Co. of the United States had no contract to buy lead concentrate, and none has been exported to the United States since January 1942. The Aguilar mine of the Compañía Minera Aguilar S. A., subsidiary of the St. Joseph Lead Co., continued to be the principal producer.

Australia.—No production figures have been published, but the 1943 output probably was somewhat below that of 1942. Mining activities were subject to critical labor shortages, which hit the production of lead and zinc. Until April 1943, Mount Isa Mines, Ltd., continued to produce lead bullion and zinc concentrate, but for the remainder of the year the output of these materials was curtailed in favor of copper production. On January 1, 1944, to balance the everchanging demands of war, the Australian Government requested that production again be concentrated on lead and zinc rather than on copper.

It is reported that an extensive underground exploratory campaign, coupled with diamond drilling by Lake George Mines, Ltd., at its property at Captain's Flat, New South Wales, has established an important lode. The ore, averaging 8 percent lead and 12 percent zinc, is concentrated by flotation.

Bolivia.—Mine production of lead in Bolivia decreased from 12,360 metric tons in 1942 to 11,387 tons in 1943. All ores and concentrates are exported, some going to Argentina for smelting and some to the United States. Exports in 1943 declined because of an increase in prices of mining materials, the difficulty of obtaining them, and the problem of transporting ores from the country. Despite the lessened incentive to produce, lead mining was encouraged in southern Bolivia, chiefly in Sud Chichos Province. Reportedly the Tito Hoyo mine—idle since 1931—was reestablished early in 1943, and production was increased at La Aviadora, La Salvadora, and La Rapida mines. The Matilde mine near Lake Titicaca, owned by Compañía Hochschild, was reported to contain 2,000,000 short tons of proved ore containing 24 percent lead, 20 percent zinc, and 1.6 ounces of silver per ton, as well as a trace of gold. The Huanchaca mine 13 miles northeast of Uyuni, the source of most of Bolivia's zinc output, is credited with about one-third of the lead production.

Brazil.—Little of interest regarding 1943 developments has been obtainable other than a report early in the year that a company was formed to exploit the lead deposits in Rio Grande do Sul. The program was sponsored by the State Government, which was to provide part of the necessary capital.

Canada.—Production of lead in Canada, including smelter production plus lead contained in exported ore, decreased from 256,071 short tons in 1942 to 222,177 tons in 1943. At least 95 percent of Canada's production of lead continues to come from the Sullivan mine of the Consolidated Mining & Smelting Co. which—according to the last available pre-war figures—contributed 11 percent of the world production. The company, which operates the only Canadian lead smelter and refinery at Trail, British Columbia, has long-term contracts with the British Government for about two-thirds of its refined-lead production at a relatively low price. Taxation throughout the year continued to be high, but despite this imposed burden plus the declining demand for lead late in 1943, new developments at smaller properties continued. The Aldermac Copper Corporation signed a contract late in the year for the sale of lead, zinc, and copper concentrates from its new mine near Sherbrooke, Quebec, to a United States smelter. It was reported that a 250-ton mill will be built and that the mine and mill equipment will be transferred from the old company property in the Noranda district. A new company, the Retallack Mines, Ltd., was organized to operate the Whitewater lead-zinc mine in the Slocan mining division. The disposal of the lead and zinc concentrates was reportedly arranged for through an agreement with the United States Commercial Co., a subsidiary of the Metals Reserve Co. In September the new mill of the New Calumet Mines, Ltd., started operating at the rate of 240 tons a day; the amount of ore was to be increased to reach the 500-ton-a-day rated capacity eventually. A Metals Reserve Co. contract for 70,000 tons of lead and zinc concentrates was negotiated.

Chile.—In June 1943, Chile's first lead smelter was completed and started operating. The plant, at Las Canas, 45 kilometers from Vallenar, is owned by the Sociedad Minera "Condorcaco."

Mexico.—Production of lead in Mexico has advanced steadily during the past 3 years; the output in 1943 amounted to 218,126 metric tons (lead content in ore) compared with 197,023 tons in 1942 and 155,259 tons in 1941. Mining was conducted under generally favorable conditions in 1943, with no serious labor troubles. The threatened industry-wide walk-out at the end of 1942 carried over into the early part of 1943 but was finally avoided. Operating companies agreed to advances in wages for workers, who also obtained additional benefits resulting from the Presidential decree of September 23, which provided for a general wage increase to labor. The so-called Bateman-Suarez agreement was renewed early in 1943 for another year, as the conditions of the agreement had proved mutually satisfactory and beneficial to both Mexico and the United States, which is the principal destination of Mexican exports. Unsatisfactory transportation facilities, both automotive and railroad, were one bad feature of the industry in 1943.

Newfoundland.—The mine production of lead, in terms of lead content of all concentrates produced, amounted to 32,940 short tons in 1943 compared with 28,007 tons in 1942. Nearly all exports of concentrates went to the United States, the remainder being destined for the United Kingdom.

Northern Rhodesia.—Northern Rhodesia is the leading producer of base metals in Africa from ore deposits containing lead, zinc, and vanadium in the Broken Hill and Lusaka districts. The Rhodesian Broken Hill Development Co., Ltd., reportedly was constructing a lead smelter in 1943 to recover the lead contained in large reserves of oxidized zinc ore, as well as a substantial tonnage of rich zinc-lead sulfide ore.

Peru.—The lead content of concentrates produced in Peru during 1943 was estimated to be 43,574 metric tons compared with 55,892 tons in 1942. This estimate is based upon reports of the major lead-producing companies. The largest part of the lead is derived from complex gold-silver-lead-zinc ores mined in the Department of Junin by the Cerro de Pasco Copper Corporation, Cia de Minas de Huaron, E. E. Fernandini, and Cia Minera Atacocha and in the Department of Puno by San Antonio de Esquilache. Minor producers operate in the Departments of Ancash, Huancavelica, and Lima. Although total production dropped in 1943, output did rise in the latter part of the year, and storage problems at some mines resulted. To alleviate this difficulty licenses were granted for shipping substantial amounts to other South American markets and Great Britain. Exports of metallic lead and lead in ore and concentrate amounted to 26,015 metric tons in 1943 (43,409 tons in 1942). According to the Over-All Metals Agreement of July 20, 1943 (effective until June 30, 1944), the price of lead was established at $0.04434 a pound of 40-percent lead concentrate or higher, f. o. b. steamer at Peruvian ports, less the usual smelting and treatment charges and deductions for metal losses and impurities. The Oroyo lead smelter recovered 43,171 metric tons of lead in 1943 (42,246 tons in 1942).

Spain.—The reported output of lead ore (concentrate?) in 1943 was 51,218 metric tons compared with 50,918 tons in 1942. The current Spanish production of lead metal has been estimated to be 34,000 metric tons a year; 21,000 tons are reserved for domestic market, and the remainder is available for export. To prevent an inflation of domestic lead prices, the Government has organized a new special service for lead (Servicio Sindical del Plomos) as a branch of the Vertical Syndicate of Metals (El Sindicato Vertical del Metal). The function of the service is to distribute among mines, smelters, and refineries the profits obtained from the sale of refined metal abroad at high prices.

Sweden.—According to plans formulated in 1943, the annual production from the Boliden Mining Co. property at Laisvall, Lapland, will be 50,000 metric tons of 13-percent lead ore. After milling, the concentrate will be shipped by truck and rail to the recently completed Rönnskär smelter, which has an annual capacity of 15,000 metric tons. This plant was originally intended for treating lead concentrate from mines in central Sweden also, but this product is reportedly now going to two new smelting works in central Sweden. Boliden's lead output will be limited to about 6,000 metric tons annually; the 1943 output reportedly was only a fraction of that amount. About 3,000 metric tons of lead concentrate are obtained annually from Kristineberg and Ravliden; all is exported.

U. S. S. R.—Little information has been obtainable from Russia during the past few years, but recent reports indicate that the lead industry was but slightly touched by the war, except for possible damage to the small Mizur lead mine in 1942. Total production in 1942 was planned to reach 100,000 tons, but there is no confirmation as to whether this goal was attained.

ZINC [1]

By A. L. RANSOME AND B. A. ESTILL

SUMMARY OUTLINE

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GENERAL SUMMARY

The ability of the zinc industry to continue to break the records established during the previous year was again demonstrated in 1943 for most phases; in fact, by now the upward gains can be almost termed commonplace. Continued Government regulatory measures helped an again-expanded smelting industry to increase the output to 5 percent above the 1942 record, even though operations were less than capacity, and to reach a level that may well be the all-time peak. Although production from domestic ore was lower than in 1942, this decline was more than offset by a substantial gain in output from foreign ore (another record), which also was sufficient to amply cover a drop in secondary redistilled-zinc production. Requirements were fully met, with enough excess to build up smelter stocks to a record high point. Some relaxation of conservation measures plus the increase in essential needs resulted in an over-all 12-percent gain in domestic consumption, yet consumers' stocks advanced 14 percent. Greater emphasis was placed on the use of high-purity metal than ever before; and the production of Special and Regular High Grades continued to increase, rather through a rise in output of electrolytic zinc than by redistillation of lower-grade zinc which decreased somewhat from 1942.

Domestic mine production was 3 percent less in 1943 despite the incentive of an enlarged premium-price plan. The lower output resulted from manpower shortages and depletion of ore reserves, largely in the Tri-State district.

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[1] This report deals primarily with the smelting branch of the industry. Full details of zinc mining are given in the various State reports. Some zinc ore is used directly in the manufacture of zinc pigments. (See chapter on Lead and Zinc Pigments and Zinc Salts.)

Total imports in 1943 again exceeded all previous records, the greater portion being in the form of zinc concentrate, largely from Mexico and Canada.

The established ceiling price of 8.25 cents a pound at St. Louis for Prime Western zinc was unchanged during 1942.

Salient statistics of the zinc industry in the United States, 1925–29 (average) and 1939–43

	1925–29 (average)	1939	1940	1941	1942	1943
Production of primary slab zinc:						
By sources:						
From domestic ores.............short tons..	589, 648	491, 058	589, 988	652, 599	629, 957	594, 250
From foreign ores....................do....	12, 734	16, 178	85, 287	169, 421	261, 915	348, 059
	602, 382	507, 236	675, 275	822, 020	891, 872	942, 309
By methods:						
Electrolytic...............percent of total..	21	25	28	27	28	35
Distilled................................do....	79	75	72	73	72	65
Production of redistilled secondary slab zinc short tons..	43, 756	50, 428	48, 917	59, 503	53, 195	48, 215
Stocks on hand at primary smelters Dec. 31 short tons..	45, 575	83, 728	19, 212	24, 212	82, 498	168, 790
Primary zinc available for consumption short tons..	548, 472	607, 464	677, 168	762, 265	730, 938	806, 252
Price:						
Prime Western at St. Louis:						
Average for year..........cents per pound..	6. 76	5. 12	6. 34	7. 48	8. 25	8. 25
Highest quotation.....................do....	8. 90	6. 50	7. 25	8. 25	8. 25	8. 25
Lowest quotation......................do....	5. 40	4. 50	5. 50	7. 25	8. 25	8. 25
Yearly average at London..............do....	6. 46	[1] 2. 89	(2)	(2)	(2)	(2)
Mine production of recoverable zinc short tons..	724, 720	583, 807	665, 068	749, 125	768, 025	744, 196
Tri-State district (Joplin)...percent of total..	49	38	35	35	31	27
Western States.........................do....	30	29	36	38	40	43
Other....................................do....	21	33	29	27	29	30
World smelter production of zinc..short tons..	1, 435, 000	1, 800, 000	1,810,000	(2)	(2)	(2)

[1] Average for 8 months; London Metal Exchange dealings suspended in September.

[2] Data not available.

WAR AGENCY REGULATIONS

Throughout 1943 the zinc industry continued to operate under Government control. After all slab zinc production had been placed under allocation on June 1, 1942, according to General Preference Order M–11, amended, two added amendments were made in 1943. The first (on February 9, 1943) tightened the control on zinc by placing remelt zinc as well as refined metal under allocation. The second, on June 7, removed restrictions on deliveries of slab zinc to the Metals Reserve Co. Because of the shortage of zinc dust at the end of 1942, this material was placed under complete allocation on December 22, 1942, according to General Preference Order M–11–1. On March 23, 1943, an amendment indefinitely extended the original order, which otherwise would have expired March 31, 1943. Subsequent amendments on July 14 and December 15 were concerned with raising the maximum quantity of zinc dust that could be delivered without allocation order and extended the right of delivery (without allocation order) to dealers as well as producers. Since the original issuance on July 24, 1942, of Conservation Order M–11–b, which restricted the use of zinc in a large number of manufactured products and prohibited its use in others, many amendments have been made. All refer to gradual tightening and subsequent easing of restrictions on the use of zinc. Reference should be made to Conservation Order M–11–b, as issued by the War Production Board, for full details of the list of prohibited and permitted uses, as well as the exceptions permitted by General Limitation Order L–71.

Figure 1 shows trends in the zinc industry since 1900.

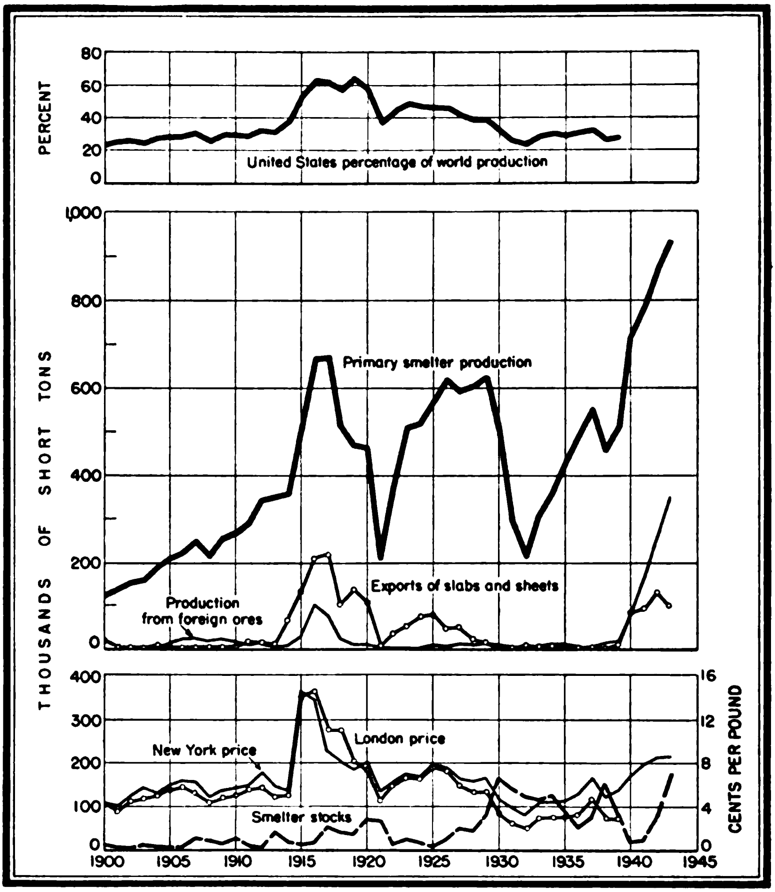

FIGURE 1.—Trends in the zinc industry in the United States, 1900–1943. Imports for consumption of slab and sheet zinc are not shown. Before 1936 they seldom exceeded 500 tons annually; but in recent years they have increased, amounting to 31,138 tons in 1939, 10,164 tons in 1940, 40,559 tons in 1941, 36,445 tons in 1942, and 56,155 tons in 1943.

The premium-price plan, whereby producers (miners) of zinc (copper and lead were also included in the plan) receive additional increments above the ceiling price for zinc (through Metals Reserve Co.) for overquota production, was maintained throughout 1943. On February 18, 1943, the scope of the Metals Reserve Co. plan was broadened to include a B and a C premium of 2.75 cents a pound each, in addition to the existing A premium of 2.75 cents. The effective time limit of the A premium was extended to July 31, 1945, with B and C premiums revokable at any time upon 30 days' notice. Under this revised plan the highest possible payment for excess production amounted to 16.5 cents a pound upon the basis of the ceiling price of 8.25 cents a pound, St. Louis, depending on the quotas assigned to the particular mine. In the Tri-State district a premium of $29.70 per ton for 60-percent concentrates was payable for overquota production for each of the assigned A, B, and C levels. This was equivalent to the 2.75-cent premium, allowing for metallurgical loss in treatment at the smelter. On October 27, 1943, the War Production Board issued a statement denying further premiums in the B and C range to zinc mines not already operating on the above date and to zinc mines having a low labor productivity and located in areas in which there is serious shortage of labor. The release also said that "* * * the Government is not now financing new zinc projects." On November 16 the above statement was clarified by the War Production Board, which explained that a mine was considered to be "already operating" on October 27 if a quota was assigned, the mine shipped metal (zinc in ore or concentrate), or expenditures for development, reconditioning, or on capital account were made on or before October 27 to bring the mine into production under the benefits of the quota plan.

SMELTING CAPACITY

Under the continued pressure of war requirements the record slab zinc production in 1943 reached a level that may be the wartime peak. The total output of 990,524 tons is somewhat short of early estimates, largely because the full capacity at smelters was not entirely utilized owing to manpower shortages that developed during 1943. Fortunately these difficulties affected output at only a few plants, and the potential tonnage of zinc lost was relatively small. According to reports to the Bureau of Mines, the zinc-producing plants in the United States on December 31, 1943, had a stated annual capacity to produce 1,091,000 tons of slab zinc under normal operating conditions. This figure, which allows for necessary shut-downs for repairs, indicates that the 1943 output was 91 percent of capacity. Using a similar comparison, primary smelters operated at 90 percent of a stated 709,000-ton capacity, electrolytic plants at 98 percent of a 338,000-ton capacity, and secondary smelters at 54 percent of a 44,000-ton capacity.

The expanded facilities for redistillation of the lower grades of zinc into high-grade metal were used to about two-thirds of capacity in 1943. The demand for the various grades generally took a more normal course toward the latter part of the year, and the need for high-grade zinc produced by redistillation declined to the point where there will probably be no necessity for this particular type of operation by the latter part of 1944.

No additional smelting capacity was under construction at the end of 1943, and only a small increase was planned at one smelter. Certainly the limit of wartime necessity has been reached, and the principal problem remains one of available supply of zinc concentrates.

SUPPLY OF ZINC CONCENTRATES

Despite the continued effort to stimulate domestic mine production of zinc by means of additional bonuses, output decreased 3 percent in 1943 owing to ore-reserve depletion in some districts—principally the Tri-State—and to acute labor shortages in others, and no major discoveries of ore were made under existing conditions. To alleviate some measure of the manpower shortage the Office of War Mobilization, on July 20, 1943, authorized the release of 4,500 men from the

Army to work in copper, zinc, and molybdenum mines of highest productivity. Of this total, approximately 1,080 (24 percent) were assigned to the zinc mines. This, of course, did help but not to any marked extent, and the drastic calling into the Army of all men under 26 years of age early in 1944 made the problem more critical than ever. Augmenting the supply of newly mined zinc in 1943, zinc was recovered from old tailings in increased amounts, from old and new lead blast-furnace slags from four slag-fuming plants (two in 1942), and from low-grade ores and plant residues by the use of an increasing number of Waelz-plant installations.

Dependence on imports of foreign ore and concentrate in 1943 was greater than ever before. Such imports reached an all-time high of 536,988 tons of zinc (content) in 1943. The rapid rise in relative amounts of foreign and domestic ore used in producing slab zinc is strikingly demonstrated by comparing the 37 percent produced from foreign ore in 1943 with the 29 percent in 1942, 21 percent in 1941, 13 percent in 1940, and only 3 percent in 1939. This does not include a substantial tonnage consumed in the manufacture of zinc pigments. The foreign supply, principally from the Western Hemisphere, comes largely from Mexico and Canada and fortunately is rail-borne. Imports from these two countries should be maintained in 1944; but imports from Australia and Argentina—which showed marked increases in 1943—probably will be lower in 1944, inasmuch as the greater part of the total from these sources came from stock-piled material now largely depleted.

All indications point to a somewhat lower over-all new supply of concentrates in 1944, both from foreign and domestic sources, sufficient to meet requirements, but with not much margin for a surplus.

POST-WAR OUTLOOK

The position of the United States has been preeminent in the zinc industry of the world over a period of many years, owing to vast resources of relatively low-grade ore. This wealth of raw material, made available largely by creating a domestic price based upon a tariff, more than supplied domestic demands in this country until the middle 1930's. Production from our mines was adequate to supply an exportable surplus, and foreign zinc was relatively unimportant to our national economy. The advent of the Second World War late in 1939 precipitated heavy demands for zinc which could not be met by domestic mine production, and imports of zinc increased rapidly. The 1942–43 rate of mine production cannot long be maintained, particularly if premium prices should be withdrawn, and it seems certain that the post-war level of domestic mining will be lower, perhaps in the range of 400,000 to 600,000 tons a year. The pent-up consumer demand to be filled in the post-war years in all probability will result in an annual minimum consumption for some years of 550,000 to 750,000 tons of slab zinc and an additional 100,000 tons more from ore used in pigments and chemicals, not including the amount needed for possible Government stock piles under consideration. These data, based upon past statistical records and current estimates of the various zinc consumers, indicate a deficit in domestic supply—including available zinc from scrap—that perforce must be made up by continued imports. The answers to the questions of future Government control, prices, and tariff cannot be foretold. It is possible that there will be limited control to bridge the gap of industrial reconversion from a war- to a peace-time economy and probable that the price of zinc will become lower; moreover, indications point to a downward trend in tariff. The domestic mines conceivably could fill the demand for new zinc for a limited time, given adequate price and tariff protection, but ore reserves have been drawn upon heavily during the war period, and it is doubtful if domestic mines will again completely and continually fulfill the zinc needs of this country, even though zinc will be mined for many years to come.

DOMESTIC PRODUCTION

PRODUCTION OF PRIMARY AND REDISTILLED SECONDARY SLAB ZINC

The production of primary slab zinc broke all records in 1943, and the 942,309-ton output exceeded the previous high point of 1942 by 6 percent. The use of foreign ore continued to reach new highs, the total zinc made from this source increasing 33 percent over 1942 as against a decrease of 6 percent in the amount of zinc produced from domestic ore.

Continued calls for a lessened supply of zinc scrap again reduced the production of redistilled slab zinc, which was 9 percent below 1942 and lower than in any year since 1938. Figures for the output of remelted secondary slab zinc are not included with those for redistilled metal. In 1943 the production of such slab zinc recovered by remelting purchased scrap amounted to 7,406 tons (10,389 tons in 1942). Zinc rolling mills and other consumers recover much more than this from their own plant scrap, but such metal normally does not enter the market as scrap and is, therefore, not measured statistically.

Primary and redistilled secondary slab zinc produced in the United States, 1939–43, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	Domestic	Foreign [1]	Total		
1939	491.058	16,178	507,236	50,428	557.664
1940	589.988	85,287	675,275	48,917	724.192
1941	652,599	169,421	822.020	59,503	881,523
1942	629,957	[2] 261,915	891,872	53.195	945,067
1943	594,250	[2] 348,059	942,309	48,215	990,524

[1] Most of the foreign ores smelted in the United States in 1939 originated in Mexico, Peru, and Argentina; in 1940–41, principally in Mexico, Canada, Newfoundland, and Peru; in 1942, in Mexico, Canada, Argentina, Newfoundland, Australia, and Peru; and in 1943, in Canada, Mexico, and Australia.

[2] Includes a small tonnage of foreign slab zinc further refined into high-grade metal in the United States.

DISTILLED AND ELECTROLYTIC ZINC

Of the primary zinc produced in 1943, 65 percent was distilled and 35 percent electrolytic compared with 72 and 28 percent in 1942.

The continuing increase in the demand for wrought-brass products for military uses again underlined in 1943 the importance of high-grade slab zinc. Although the available capacity for redistilling Selected and Prime Western zinc into high-grade zinc was not fully utilized, the increased capacity for producing electrolytic high-grade zinc was used nearly 100 percent, with the result that the record primary electrolytic zinc output in 1943 was 30 percent above 1942 and more than sufficient to balance a 4-percent decrease in production of distilled primary zinc. Production of Special High Grade gained 27 percent and Regular (ordinary) High Grade 21 percent in contrast with Selected and Prime Western production, which was 24 and 16 percent lower, respectively. Of course the original first-stage smelter production of these two lower grades of zinc was somewhat higher than is indicated in the following table; but to avoid duplication, the quantity of each grade consumed in the redistilling operation was discounted. The resultant Special and Regular High-Grade slab zinc produced is included. It is believed that the data shown thus give a more accurate picture of the quantity and grades of zinc actually made available for use. Of the total 1943 production (comparable 1942 figures in parentheses), 31 percent (27 percent) was Regular High Grade, 30 percent (24 percent) Special High Grade, 23 percent (29 percent) Prime Western, 8 percent (9 percent) Brass Special, 6 percent (8 percent) Intermediate, and 2 percent (3 percent) Selected.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1939–43, in short tons

APPORTIONED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled primary	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1939	127, 056	380, 180	23, 471	26, 957	557, 664
1940	187, 040	488, 235	20, 003	28, 914	724, 192
1941	224, 313	597, 707	27, 904	31, 599	881. 523
1942	252, 987	638, 885	20, 978	32, 217	945. 067
1943	329, 902	612, 407	24, 385	23, 830	990, 524

APPORTIONED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D		Grade E (Prime Western)	Total
	Special High Grade (99.99% Zn)	Ordinary		Brass Special	Selected		
1939	162, 345		66, 591	86, 274		242, 454	557, 664
1940	195, 119	98, 940	65, 321	80, 681		284, 131	724. 192
1941	203. 030	177, 451	74, 797	73. 968	5, 152	347, 125	881. 523
1942	231, 422	250. 501	77, 527	86, 176	26, 800	272, 641	945. 067
1943	293, 168	303, 743	62, 700	82, 072	20, 445	228, 396	990, 524

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

PRODUCTION OF PRIMARY SLAB ZINC BY STATES

Montana was the leading producer of primary slab zinc in 1943 and took the position held by Pennsylvania since 1934, when it in turn displaced Montana for first place. Illinois ranked second, closely followed by Pennsylvania. Of the States for which production figures may be released, Oklahoma, Idaho, and Arkansas occupied the next three positions, in order of decreasing importance. Pennsylvania, Oklahoma, and Arkansas had less production than in 1942, and Illinois continued to be the leader in rate of increase—26 percent in 1943 (44 percent in 1942). Montana and Idaho, as usual, produced electrolytic zinc only, Illinois and Texas made both electrolytic and distilled metal, and all other States confined their operations to distillation alone. One new State—Missouri—was added to the roster with the experimental production of slab zinc directly from the treatment of lead-smelter slag by the fuming process.

Primary slab zinc produced in the United States, by States where smelted, 1939–43, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Other States[1]	Total	
								Short tons	Value
1939	19, 892	18, 427	79, 480	108, 629	84, 551	155, 598	40. 659	507, 236	$52, 753, 000
1940	35. 497	37, 477	101, 819	149, 563	96, 689	175, 352	78, 878	675, 275	85, 085, 000
1941	44, 045	39, 285	121, 921	176. 406	105. 885	222, 486	111, 992	822. 020	123. 303, 000
1942	41, 649	39, 916	175, 455	193. 486	102, 422	231, 362	107, 582	891, 872	155, 186, 000
1943	35, 704	41, 129	221, 680	237, 585	72, 043	218, 058	116. 110	942, 309	162, 756, 000

[1] Texas and West Virginia; also Missouri in 1943.

SECONDARY ZINC

In addition to the redistilled secondary slab zinc (unalloyed) already reported herein, some remelted slab zinc is produced, and a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Additional information on secondary zinc is given in the chapter on Secondary Metals—Nonferrous.

BYPRODUCT SULFURIC ACID

Sulfuric acid made from the sulfur dioxide gases produced in roasting zinc blende (sphalerite) is an important byproduct of zinc smelting. To utilize a larger proportion of their acid-producing capacity, some plants also consume large quantities of sulfur. The production of sulfuric acid at zinc-blende roasting plants showed a strong gain of 19 percent in 1943.

Sulfuric acid (60° B. basis) made at zinc-blende roasting plants in the United States, 1939–43

Year	Made from zinc blende[1]		Made from sulfur		Total[1]		
						Value[2]	
	Short tons	Value[2]	Short tons	Value[2]	Short tons	Total	Average per ton
1939	528, 872	$4, 765, 137	102, 663	$924, 993	631, 535	$5, 690, 130	$9. 01
1940	586. 912	5, 364. 376	134, 250	1, 227, 045	721, 162	6, 591, 421	9. 14
1941	672, 177	5, 706. 783	148, 257	1, 258, 702	820, 434	6, 965, 485	8. 49
1942	695, 242	6, 570, 037	147, 513	1, 393, 998	842, 755	7, 964, 035	9. 45
1943	846, 875	8, 104, 594	155, 210	1, 485, 359	1, 002, 085	9, 589, 953	9. 57

[1] Includes acid from foreign blende.

[2] At average of sales of 60° acid.

ZINC DUST

The production of 25,990 short tons of zinc dust in 1943 broke all previous records; it was 6 percent above the former high point reached in 1941 and 14 percent over the 1942 output. The zinc content of the dust ranged from 95.0 to 99.6 percent and averaged 97.5 percent. Shipments of zinc dust in 1943 totaled 25,552 tons, of which 3,429 tons or 13 percent went to foreign countries (according to data submitted to the Bureau of Mines). This figure is possibly somewhat low, as Government purchases (of which at least a considerable portion was eventually shipped abroad) were not given separately, and a part of this quantity no doubt was included under domestic shipments. By far the largest group use of zinc dust is in chemical manufacturing, with sodium hydrosulfite the principal single item. According to data compiled by the Zinc Division of the War Production Board, 20,830 tons of zinc dust were used in 1943, of which 10,415 tons (50 percent) went into the making of sodium hydrosulfite. Production and shipments of zinc dust in 1943 were about in balance, and producers' stocks showed only a moderate increase from 1,259 tons at the beginning to 1,421 tons at the close of the year. The average price of zinc dust shipped to domestic consumers in 1943 was 10.1 cents per pound compared with 10.4 cents in 1942. The raw materials used to manufacture zinc dust are reviewed in the chapter on Secondary Metals—Nonferrous. More than three-fourths of it is produced from zinc scrap, principally galvanizers' dross, and the remainder is made from zinc ore, slab zinc, and as a byproduct of zinc refining.

Zinc dust[1] *produced in the United States, 1939–43*

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1939	16,835	$2,367,861	$0.070	1942	22,805	$4,789,050	$0.105
1940	20,731	3,404,970	.082	1943	25,990	5,170,647	.101
1941	24,429	4,641,580	.095				

[1] All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and lithopone, and the principal salts are the chloride and sulfate. These products are manufactured from various zinciferous materials, including ore, metal, scrap, and residues. Details of the production of zinc pigments and salts are given in the chapter on Lead and Zinc Pigments and Zinc Salts.

MINE PRODUCTION

Mine production of recoverable zinc (including that made into zinc pigments) in the United States decreased 3 percent in 1943. Increases in output from 13 of the 21 zinc-producing States were insufficient to balance a drop from the other 8 States. The general over-all decline in production was due to several reasons, including exhaustion of developed ore reserves, manpower shortages, and inefficiency of the too few replacements available.

Zinc mining operations are largely centered in five localities—the Tri-State area of Kansas, Southwestern Missouri, and Oklahoma; Tennessee-Virginia; Essex County, N. J.; St. Lawrence County, N. Y.; and the Western States (principally Idaho, New Mexico, Utah, Colorado, and Montana). The Western States output advanced 12,221 tons or 4 percent, the Central States decreased 35,474 tons (14 percent), and the Eastern States total remained virtually unchanged. The Tri-State area (Joplin region), maintained its position as the principal zinc-producing district, with 27 percent of the total United States output even though production decreased 37,422 tons in 1943. To some extent this drop was due to severe floods in May which caused the temporary shut-down of many mines in that area but largely was because of a continuing depletion of high- and medium-grade ore reserves. Oklahoma continued to be the principal producer in the country, contributing half the yield from the Central States, but the gap between Oklahoma and New Jersey (the leading producer in the Eastern States and the second in the country) was narrowed considerably.

All Western States except Idaho, Montana, South Dakota, and Washington gained in production during 1943 and together supplied 43 percent of the domestic total. Idaho again was the largest producer in this region despite a minor decline of less than 1 percent. A large increase from the new Bunker Hill slag-fuming plant was insufficient to out-weigh declines from other large properties, including

Mine production of recoverable zinc in the United States, 1925–29 (average) and 1939–43, by States, in short tons

State	1925–29 (average)	1939	1940	1941	1942	1943
Western States:						
Arizona	2,628	6,711	15,456	16,493	18,522	19,677
California	3,999	6	79	440	613	1,856
Colorado	32,868	1,830	5,060	15,722	32,215	44,094
Idaho	29,128	47,549	70,601	79,084	87,256	86,707
Montana	72,519	34,799	52,587	60,710	54,715	37,606
Nevada	5,570	6,228	11,833	15,129	10,197	13,647
New Mexico	23,351	29,356	30,313	37,862	46,461	59,524
South Dakota	-------	-------	-------	-------	115	46
Utah	44,385	34,526	43,788	42,049	45,543	46,896
Washington	575	10,131	11,560	14,320	14,398	12,203
	215,023	171,136	241,277	281,809	310,035	322,256
Central States:						
Arkansas	71	123	440	206	181	96
Illinois	1,174	334	4,818	9,198	9,389	5,851
Kansas	114,323	68,971	57,032	71,403	55,874	56,944
Kentucky	644	909	1,278	427	407	931
Missouri	16,708	15,096	12,703	21,932	36,394	30,413
Oklahoma	226,969	140,379	162,935	166,602	146,510	114,085
Wisconsin	23,055	5,904	5,770	6,238	9,426	14,387
	382,944	231,716	244,976	276,006	258,181	222,707
Eastern States:						
New Jersey	93,839	88,716	91,406	93,781	94,040	92,864
New York	7,091	36,014	35,686	38,446	45,807	46,000
Tennessee	14,631	32,375	34,796	36,170	43,971	41,766
Virginia	11,192	23,850	16,927	22,913	15,991	18,603
	126,753	180,955	178,815	191,310	199,809	199,233
	724,720	583,807	665,068	749,125	768,025	744,196

the Hecla. Second place went to New Mexico in 1943 owing to a marked increase of 28 percent in output, which came principally from the Central district. Utah was third, followed closely by Colorado, with a 37-percent increase over 1942 and the largest output of any year since 1918. Montana's 31-percent decrease was due to a lower production of zinc-lead ores from the Butte district. Additional data on mine production of zinc are given in the separate chapters covering each State.

Mine production of recoverable zinc in the United States, by districts that produced 1,000 tons or more during any year, 1939–43, in short tons

District	State	1939	1940	1941	1942	1943
Joplin region	Kansas, southwestern Missouri, Oklahoma.	224,446	232,437	258,837	237,936	200,514
New Jersey	New Jersey	88,716	91,406	93,781	94,040	92,864
Coeur d'Alene region	Idaho	40,065	62,948	68,321	78,313	79,634
Central	New Mexico	23,677	29,573	34,649	42,374	52,215
St. Lawrence County	New York	36,014	35,686	38,446	45,807	46,000
Eastern Tennessee	Tennessee	32,375	34,796	36,170	[1] 43,971	[1] 41,766
Red Cliff	Colorado			10,880	22,880	28,854
Smelter	Montana	12,639	14,462	18,751	20,190	24,165
Bingham	Utah	20,861	21,812	20,496	22,634	23,405
Austinville	Virginia	23,850	[1] 16,927	[1] 22,913	15,793	17,139
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	5,904	5,776	7,956	11,126	15,539
Pioche	Nevada	5,737	10,773	14,391	8,957	11,991
Park City region	Utah	9,054	17,598	16,177	13,026	11,487
Metaline	Washington	10,130	11,560	14,201	13,620	9,292
Rush Valley	Utah	2,370	2,971	3,726	7,625	8,880
Summit Valley (Butte)	Montana	20,016	35,899	38,070	29,313	7,877
Kentucky-southern Illinois	Kentucky-southern Illinois	1,243	6,090	7,907	8,096	5,630
Leadville	Colorado	172	172	48	3,344	5,512
Magdalena	New Mexico	317	206	2,580	3,185	5,290
Warm Springs	Idaho	7,463	7,104	8,534	6,260	4,740
Pioneer (Superior)	Arizona	2,000	3,175	4,139	3,884	4,072
Pioneer (Rico)	Colorado	867	2,607	3,008	2,764	3,652
Harshaw	Arizona	1,075	2,714	3,531	4,825	3,398
Big Bug	do	110	1,740	1,804	2,650	3,009
Old Hat (Oracle)	do				579	2,450
Tintic	Utah	851	225	797	1,708	2,330
Patagonia	Arizona		990	1,788	1,913	1,931
Chelan Lake	Washington					1,930
Wallapai	Arizona	770	4,295	2,346	2,244	1,542
Pima	do					1,390
Upper San Miguel	Colorado				390	1,213
Warren	Arizona	7	1,812	2,095	1,449	1,020
Packer Creek	Montana					1,001
Heddleston	do			548	1,266	953
South Mountain	Idaho		540	2,201	1,485	633
Animas	Colorado	574	1,394	832	379	474
Eagle	Montana	394	418	1,048	348	256
Montana	do	5	713	1,474	489	203
Ophir	Utah	1,268	603	173	189	127
Cataract	Montana	1,070	773	93		26
Oro Blanco	Arizona	2,377	484			
Willow Creek	New Mexico	4,925				
Livingston	Virginia				(2)	(2)

[1] Includes very small quantity produced elsewhere in State.
[2] Bureau of Mines not at liberty to publish figures.

STOCKS

PRODUCERS' STOCKS

An outstanding feature of the zinc industry in 1943 was the all-time high record producers' stock total attained by the end of the year—102 percent above the quantity on hand at the beginning. However, of this physical inventory at the plants, only 22 percent was company-owned, the remainder being held for the account of the Metals Reserve Co. All of the gain was at the primary reduction plants, as stocks at secondary distilling plants, although comparatively small, declined 6 percent. Of the total stocks on hand at the end of the year, 106,588 tons were Special and Regular High Grade and Intermediate and the remainder (64,037 tons) were of lower grades, compared with 17,917 tons and 66,523 tons, respectively, at the end of 1942. Nearly the entire inventory gain can be accounted for by the accumulation of the two highest grades, and the total represents better than 2 months' requirements upon the basis of smelter shipments in 1943.

According to the American Zinc Institute, stocks of slab zinc followed a constant upward trend throughout 1943.

Stocks of zinc on hand at zinc-reduction plants in the United States at end of year, 1939–43, in short tons

	1939	1940	1941	1942 [1]	1943
At primary reduction plants	83,728	19,212	24,212	82,498	168,790
At secondary distilling plants	2,555	761	890	1,942	1,835
	86,283	19,973	25,102	84,440	170,625

[1] Revised.

Stocks of zinc ore (60 percent concentrates) in the Tri-State district (as reported by the Tri-State Zinc and Lead Ore Producers' Association) on January 2, 1943, were only 957 tons, the lowest point reached in 1943, but rose sharply to 3,535 tons by January 9 and then to 3,989 tons by January 16, followed by a gradual decline to 2,621 tons on February 6. With the exception of the end of April this general cyclic trend of rising stocks during the month, followed by a drop in inventory at or near the end of the period, continued throughout the year. This trend, first noticed during the last three quarters of 1942, is apparently the result of the premium-price plan, which encourages the practice of making heavy shipments at the end of the month, with a consequent drop in inventories. In general, the trend in stocks was upward during the year, the high point of 6,952 tons being reached on December 25. This was followed by a decrease to 5,315 tons on January 1, 1944.

According to an American Zinc Institute survey, total stocks of domestic and foreign zinc ore and concentrates at primary reduction plants on December 31, 1943, totaled 673,247 tons averaging 54 percent zinc compared with 540,339 tons containing 55 percent zinc at the end of 1942. The Bureau of Mines in 1943 asked for comprehensive data covering all raw material used at zinc-processing plants. This information, received for the first time, was submitted too late to be included here, but is to be used as the basis for a release to be published at an early date.

CONSUMERS' STOCKS

Stocks of slab zinc at consumers' plants continued to advance in 1943, and the total on December 31 showed a net gain of 14 percent above the quantity at the beginning of the year. Inventories increased steadily from the first of the year until June 30, when the maximum of 87,100 tons was reached; this was followed by a decline to 74,000 tons by October 30. Both galvanizers and manufacturers of brass products showed increases in stocks; the former advanced 13 percent, the latter exhibited a marked gain of 29 percent. Because of variance in coverage and certain changes in industrial classification, all figures on stocks for December 31, 1942, that appeared in the 1942 chapter were revised. The largest change—in the brass-mill group—was upward and reflects the addition of several new brass mills that were not covered in 1942. At the average monthly rate of consumption in 1943, consumers' stocks on hand at the end of 1943 were adequate for about 1¼ months' requirements.

In addition to physical stocks on hand at consumers' plants at the end of 1943, 16,500 tons of zinc were in transit to consumers, held for redistillation, and in dealers' hands. Exclusive of an indeterminate quantity in bonded warehouses, the approximate total slab zince in stock (including inventories at producers' plants) on December 31, 1943, amounted to 273,000 tons. The comparative figure at the end of 1942 was 181,000 tons (revised).

Consumers' stocks of slab zinc at plants at the beginning and end of 1943, by industries in short tons

	Galvanizers	Die casters [1]	Brass mills [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1942 [3]	25,140	9,184	35,982	3,063	532	1,588	75,489
Dec. 31, 1943	28,492	6,266	46,335	2,580	1,027	1,516	86,216

[1] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[2] Includes brass mills, brass ingot makers, and brass foundries.
[3] Revised figures.

DOMESTIC CONSUMPTION

NEW SUPPLY

The following table shows the 5-year trend of primary slab zinc available for consumption in the United States. This calculated quantity, in effect, is equivalent to the slab zinc apparently made available each year for shipment to domestic consumers during the year.

In addition to primary zinc, 48,322 tons of redistilled secondary metal were made available to consumers in 1943 after allowance for a slight decrease in stocks at secondary smelters.

Primary slab zinc available for consumption in the United States, 1939–43, in short tons

	1939	1940	1941	1942	1943
Supply:					
Stock at smelters Jan. 1	157,511	83,728	19,212	24,212	82,498
Production	507,236	675,275	822,020	[2] 886,810	[2] 933,828
Imports for consumption	30,960	[1] 16,468	[1] 34,554	[1] 36,352	[1] 56,155
Total available	695,707	775,471	875,786	947,374	1,072,481
Withdrawn:					
Exports	4,515	79,091	89,309	133,938	97,439
Stock at smelters Dec. 31	83,728	19,212	24,212	82,498	168,790
Total withdrawn	88,243	98,303	113,521	216,436	266,229
Available for consumption	607,464	677,168	762,265	730,938	806,252

[1] General imports.
[2] Adjusted to exclude imported slab zinc further refined into high-grade metal in the United States.

CONSUMPTION

According to reports from 650 plants, representing an estimated 97 percent of the consuming industry in the United States, 816,777 tons of slab zinc were put in process in 1943, a 12-percent increase from the 1942 total of 728,169 tons. Receipts for this same period were 827,504 tons. The apparent discrepancy between this figure and the calculated 854,574 tons of primary and secondary slab zinc shipped to domestic consumers in 1943 can be attributed largely to incomplete coverage of the survey, although variations in metal in transit and unaccounted-for slab zinc stored in bonded warehouses certainly are factors to be considered.

The influence of continued Government control is indicated by certain comparisons of the 1943 data with those for 1942. The manufacture of brass products—an increasing "must" in the category of essential requirements—consumed 31 percent more zinc than in 1942. The limited relaxation in the control of zinc used in galvanized products was reflected in a 2-percent gain for the galvanizing group. The

Consumption of slab zinc in the United States, 1941–43, by industries, in short tons[1]

Industry and product	1941	1942	1943
Galvanizing:[2]			
Sheet and strip	129.028	76,106	72,233
Tubes and pipe	69,749	47.085	51,023
Wire and wire rope	41,408	35,216	37,391
Wire cloth	11,307	7,320	(3)
Fittings	(3)	(3)	14.549
Other[4]	99,362	81,764	78.005
	350,854	247,491	253.201
Brass products:			
Sheet, strip, and plate	195,714	292,820	287,962
Rod and wire			66,538
Tube			24,456
Castings and billets	82,324	27,126	16,851
Copper-base ingots			20,384
Other copper-base products			2,888
	228,038	319.946	419.079
Zinc-base alloy:			
Die castings	150,853	58,918	60.115
Alloy dies and rod		21,227	16,067
Slush and sand castings	(5)	(5)	143
	150,853	80,145	76,325
Rolled zinc	72,049	66,045	48,529
Zinc oxide	16,128	7,977	11,496
Other uses:			
Slush castings	751	552	(6)
Wet batteries	1,767	1,667	1,807
Desilverizing lead	1,431	1,251	2,178
Light-metal alloys	(3)	(3)	1,074
Miscellaneous[7]	5,564	3,095	8.088
	9,513	6,565	8,147
Total: All uses	827,435	728,169	816,777

[1] Based on a canvass of 600 plants in 1941 and 1942 and a somewhat larger coverage in 1943, mostly from small consumers.
[2] Includes zinc used in electrogalvanizing, but excludes sherardizing.
[3] Separate figures not available but included in the total.
[4] Includes miscellaneous articles not elsewhere mentioned.
[5] Included under "Other uses" in 1941 and 1942.
[6] Included under "Zinc-base alloy."
[7] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.

manufacture of zinc-base alloy declined moderately, and rolled-zinc ouput was less. On the other hand, the need for increased quantities of French-process zinc oxide for military uses resulted in the allocation of more zinc for this purpose; consumption advanced markedly. Details are shown in the preceding table, which gives a more comprehensive use division in 1943 than has been available heretofore.

Although the consumption of zinc for galvanizing sheet and strip declined slightly, the quantity used for this purpose was only 29 percent of the total employed in all galvanizing as compared with 31 percent in 1942 and 37 percent in 1941. The use of zinc in tubes and pipe, and wire and wire rope, increased in 1943, and zinc used in coating fittings and shapes ("other") was 13 percent more and comprised 37 percent of the total as against 33 percent in 1942. Separate data on wire cloth were not obtained in 1943, and the zinc used in fittings was not reported in previous years, being included in the "other" group.

Brass mills, foundries, and ingot makers consumed 51 percent of the total zinc used compared with 44 percent in 1942 and almost doubled the 1941 ratio. No direct comparison of the detailed brass-products divisions can be made, but the largest gain probably was in sheet, strip, and plate for use in making cartridges and shell cases. Production at several small arms plants was cut back late in 1943, but the resulting decrease in zinc consumption was minor compared with the enormous comparative total used at all such plants.

The use of zinc for die castings gained slightly in 1943, whereas zinc for alloy dies and rod was less. This does not mean that the use of stamping dies (the principal product in this category) was less, but rather that the saturation point—resulting from the expanded aircraft program—had been reached and that less new zinc was needed. A particular advantage of these zinc-base alloy dies is the ease with which they can be remelted and re-formed for use again.

The necessity of utilizing slab zinc in even greater quantities for more essential needs than rolled zinc resulted in a marked reduction (27 percent) in the consumption of zinc for this purpose. In addition to slab zinc, the rolling mills remelt and reroll the metallic scrap produced from their fabricating operations. The scrap so treated in 1943 amounted to 12,809 tons—an 18-percent drop from 1942. Only 811 tons of purchased zinc scrap in the form of zinc clippings, old zinc scrap, and engravers' plates were melted and rolled in 1943 (2,023 tons in 1942). The zinc lost in waste products such as skimmings and ashes totaled 1,194 tons in 1943, equivalent to 2.4 percent of the net production of rolled zinc. Production of rolled zinc from these raw materials (including 37 tons of purchased remelt spelter) amounted to 48,126 tons—a decrease of 28 percent from 1942. The total value of the rolled products was 29 percent less than in 1942; but the decrease was proportional to the lowered output, and the average price of $0.120 remained virtually unchanged from $0.122 in 1942. Inventories of rolled zinc were 1,361 tons on December 31, 1943, compared with 1,627 tons (revised) on the same date in 1942. In addition to the actual shipments of 32,875 tons of rolled zinc in 1943, the rolling mills consumed 28,326 tons of rolled zinc (including that which was remelted and rerolled) in the manufacture of 15,517 tons of fabricated products..

Rolled zinc produced and quantity available for consumption in the United States, 1942–43

	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Production:						
Sheet zinc not over 0.1 inch thick	14,554	$4,191,000	$0.144	9,099	$2,571,000	$0.141
Boiler plate and sheets over 0.1 inch thick	3,542	790,000	.112	3,628	807,000	.111
Strip and ribbon zinc [1]	46,930	10,610,000	.113	33,979	7,647,000	.113
Foil, rod, and wire	1,413	564,000	.200	1,420	497,000	.175
Total rolled zinc	66,439	16,155,000	.122	48,126	11,522,000	.120
Imports	50	10,100	.101	(2)	---	---
Exports	3,880	1,013,500	.131	2,281	624,100	.137
Available for consumption	[3] 62,272	---	---	[3] 46,111	---	---
Value of slab zinc (all grades)	---	---	.087	---	---	.086
Value added by rolling	---	---	.035	---	---	.034

[1] Figures represent net production. In addition, 15,641 tons of strip and ribbon zinc in 1942 and 12,809 tons in 1943 were rerolled from scrap originating in fabricating plants operated in connection with zinc rolling mills.

[2] Less than 1 ton.

[3] Allowances made for change in producers' stocks of rolled zinc.

The following table shows the six commercial grades of refined slab zinc consumed by the various industries in 1943. Of the 816,777 tons of domestic and foreign zinc consumed, 31 percent was Prime Western, 29 percent Special High Grade, and 27 percent Regular High Grade. Prime Western was the principal grade used by galvanizers in the hot-dip process, the high grades—largely in the form of anodes—being used for the most part for electrogalvanizing. Although all grades were used in making brass products, the need for high-purity metal for lead-free cartidge brass has resulted in 87 percent of the slab zinc used being of the three highest grades. Zinc used for zinc-base alloy products was limited almost entirely to Special and Regular High Grade because of rigid specification requirements, as was also the case with zinc oxide.

Consumption of slab zinc in the United States in 1943, by grades, according to industry, in short tons

	Special High Grade	Regular High Grade	Intermediate	Brass Special	Selected	Prime Western	Total
Galvanizing	7,423	6,427	9,764	9,727	787	219,073	253,201
Brass products	147,353	182,903	34,940	24,337	8,055	21,491	419,079
Zinc-base alloy	73,742	2,445	105	---	---	33	76,325
Rolled zinc	3,260	15,832	3,900	18,854	---	6,683	48,529
Zinc oxide	1,939	8,947	---	---	---	610	11,496
Other uses	1,245	2,055	969	400	---	3,478	8,147
Total	234,962	218,609	49,678	53,318	8,842	251,368	816,777

PRICES

The base ceiling price of 8.25 cents a pound for Prime Western at St. Louis and $55.28 per ton of 60-percent zinc concentrates at Joplin remained unchanged throughout the year. For comparison it is interesting to note that the average price received by the primary producers for all grades of zinc sold in 1943 was 8.6 cents a pound, f. o. b. plants (8.7 cents in 1942). The 1943 price of 10.8 cents for zinc, which appears in the separate State chapters, represents the above weighted average price received for slab zinc plus the increment—in terms of cents per pound based upon the total recoverable zinc output—of $33,300,000 in overquota A, B, and C premiums paid by the Metals Reserve Co. The premium-price plan is briefly outlined in this chapter under the heading, War Agency Regulations.

The official London maximum price of £25 15s. for foreign zinc delivered to consumers, duty paid, and £26 10s. for domestic metal remained unchanged throughout 1943.

Price of zinc and zinc concentrates, 1939–43

	1939	1940	1941	1942	1943
Average price common zinc at—					
St. Louis (spot) cents per pound	5.12	6.34	7.48	8.25	8.25
New York do	5.51	6.73	7.87	8.66	8.66
London do	[1] 2.89	(2)	(2)	(2)	(2)
Excess New York over London do	[3] 2.03	(4)	(4)	(4)	(4)
Joplin 60-percent zinc concentrates:					
Price per short ton dollars	34.15	41.87	49.80	55.28	55.28
Price of zinc content cents per pound	2.85	3.49	4.15	4.61	4.61
Smelter margin do	2.27	2.85	3.33	3.64	3.64
Price indexes (1925–29 average=100):					
Zinc (New York)	77	95	111	122	122
Lead (New York)	68	69	78	87	87
Copper (New York)	75	77	80	80	80
Nonferrous metals [5]	79	82	85	87	87
All commodities [5]	79	80	89	101	106

[1] Average for 8 months; London Metal Exchange dealings suspended in September.

[2] Official maximum price fixed by British Ministry of Supply at £25 15s., equivalent to 4.64 cents a pound at the official 1941–43 rate of exchange.

[3] Difference based upon 8 month-averages.

[4] Not available.

[5] Based upon price indexes of U. S. Department of Labor.

Average monthly quoted prices of common zinc (prompt delivery or spot) at St. Louis and London, and of 60-percent zinc concentrates at Joplin, 1942–43 [1]

Month	1942			1943		
	60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)		60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)	
		St. Louis	London		St. Louis	London
January	$55.28	8.25	(2)	$55.28	8.25	(2)
February	55.28	8.25		55.28	8.25	
March	55.28	8.25		55.28	8.25	
April	55.28	8.25		55.28	8.25	
May	55.28	8.25		55.28	8.25	
June	55.28	8.25		55.28	8.25	
July	55.28	8.25		55.28	8.25	
August	55.28	8.25		55.28	8.25	
September	55.28	8.25		55.28	8.25	
October	55.28	8.25		55.28	8.25	
November	55.28	8.25		55.28	8.25	
December	55.28	8.25		55.28	8.25	
Average for year	55.28	8.25	(2)	55.28	8.25	(2)

[1] Quotations from Metal Statistics, 1944.

[2] Official maximum price fixed by British Ministry of Supply at £25 15s., equivalent to 4.64 cents a pound at the official 1942–43 rate of exchange.

Average price received by producers for zinc, 1939–43, by grades, in cents per pound

	1939	1940	1941	1942[2]	1943[2]
Grade A:[1]					
Special High Grade	5.34	6.59	8.04	9.00	8.91
Regular High Grade			7.74	9.10	8.74
Grade B: Intermediate			7.52	8.64	8.71
Grades C and D:[1]					
Brass Special	5.00	6.04	7.37	8.32	8.46
Selected			6.64	8.18	7.95
Grade E: Prime Western	5.08	6.14	7.16	8.23	8.31
All grades	5.2	6.3	7.5	8.7	8.6
Prime Western; spot quotation at St. Louis	5.1	6.3	7.5	8.25	8.25

[1] American Metal Market quotes average prices of High Grade and Brass Special as follows: High Grade (f. o. b. New York)—1939, 6.16 cents; 1940, 7.38 cents; 1941, 8.48 cents; 1942, 9.25 cents; 1943, 9.25 cents. Brass Special (f. o. b. East St. Louis)—1939, 5.22 cents; 1940, 6.44 cents; 1941, 7.68 cents; 1942, 8.50 cents; 1943, 8.50 cents.

[2] Does not include overquota premium payments made by Metals Reserve Co.

ZINC-REDUCTION PLANTS

ZINC SMELTERS

There was no change in the number of zinc smelters in 1943. For the past 3 years there have been 17 active plants, of which 13 operated with horizontal retorts exclusively, 1 with both horizontal and vertical retorts, 2 with large vertical retorts, and 1 with electrothermic furnaces. The total number of retorts reported at the horizontal-retort primary plants was 72,712, an increase of 7 percent over the 67,816 at these plants on December 31, 1942. The gain was the result of completion during 1943 of 4,896 retorts under construction at the end of 1942. Of the total retorts reported, 68,232 were in use at the close of 1943—a gain of 4 percent over the 65,508 in operation at the end of 1941. That this gain did not parallel the increase in new capacity was due largely to shortage of adequate manpower, which necessitated the closing several blocks of retorts at some plants, and only 94 percent of the total available was in operation at the end of 1943. Of the 66 vertical retorts in the United States, 64 were in operation at the close of the year.

Nine primary plants in 1943 (12 in 1942) produced zinc from zinc scrap and residues such as zinc skimmings and dross which were distilled in the same retorts as the sintered concentrate. In addition to the 17 primary producers, 11 plants (15 in 1942) produced redistilled secondary slab zinc by treating scrap zinc and other secondary zinciferous materials in clay retorts, graphite crucibles, and two special furnace installations. These 11 plants reported a total of 2,456 retorts and 105 crucibles on December 31, 1943, of which 1,180 retorts and 41 crucibles were in operation. Part of this available production capacity at secondary smelters was used to produce zinc dust and zinc oxide in addition to slab zinc.

During the latter part of 1943 the St. Joseph Lead Co. operated its new slag-fuming plant at Herculaneum, Mo., and experimentally recovered a small tonnage of slab zinc as a direct product of the operation, which treats lead-smelter slags containing some zinc. This plant is unique in that it is the only one of the four slag-fuming plants in the country that has produced metal directly, the usual product being an impure zinc oxide generally shipped to a zinc smelter for reduction to metal.

ELECTROLYTIC PLANTS

Five electrolytic plants were in operation during 1943, the same as in 1942; all produced at, or close to, capacity throughout the year. There were 3,204 cells at the plants on December 31, 1943, out of which total 3,128 (98 percent) were in operation. No new installations were reported under construction or planned.

FOREIGN TRADE[2]

IMPORTS

The following tables give total zinc imports (general) in ore and blocks, pigs, or slabs into the United States, 1941–43, and imports for consumption. Of the 536,988 tons of zinc imported in ore, 31 percent came from Mexico, 22 percent from Australia, and 21 percent from Canada. Receipts from Australia were almost three times larger than in 1942, and Canada supplied 33 percent more in 1943. All countries except Peru increased their shipments to the United States. Substantially all imports credited to Chile are from Bolivia and were shipped from Chilean ports. Imports of slab zinc from Canada were two and a half times that in 1942, and receipts from Mexico increased 33 percent.

Zinc imported into the United States in ore, blocks, pigs, or slabs, 1941–43, by countries, in short tons[1]

Country	1941	1942	1943
Ore (zinc content):			
Argentina	20, 579	23, 395	53, 452
Australia	8, 933	32, 212	120, 244
Belgian Congo	12, 563	2, 873	14, 835
Bolivia	2, 687	5, 893	2, 760
Canada	49, 764	78, 104	110, 343
Chile[3]	2, 157	6, 872	14, 369
Mexico	148, 201	160, 959	166, 135
Newfoundland and Labrador	7, 267	30, 550	32, 949
Peru	28, 833	27, 506	21, 901
Spain	8, 227		
Other countries	2	44	(2)
	289, 213	368, 408	536, 988
Blocks, pigs, or slabs:			
Canada	7, 236	1, 749	8, 570
Indochina, French	1, 653		
Mexico	25, 621	34, 603	45, 344
Other countries	44		2, 241
	34, 554	36, 352	56, 155

[1] Data include ore imported for immediate consumption plus material entering country under bond.
[2] Less than 1 ton.
[3] Substantially all zinc shown as received from Chile originated in Bolivia and was shipped from Chilean ports.

Zinc imported for consumption in the United States, 1939–43, by classes

Year	Ores (zinc content)		Blocks, pigs, or slabs		Sheets		Old, dross, and skimmings[1]		Zinc dust		Total value[2]
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1939	33, 503	$1, 304, 433	30, 960	$1, 890, 236	178	$21, 166	203	$14, 067	41	$3, 388	$3, 233, 290
1940	44, 637	1, 108, 361	10, 146	801, 331	18	2, 796	520	36, 689			1, 949, 177
1941	154, 520	4, 596, 480	40, 288	3, 661, 549	271	54, 464	456	31, 695	140	21, 495	8, 365, 683
1942	283, 167	10, 723, 983	36, 352	2, 924, 438	50	10, 086	3, 357	158, 929	702	43, 464	13, 860, 900
1943	514, 571	20, 417, 219	56, 155	5, 825, 874	(3)	56	5, 146	227, 270	106	17, 585	26, 488, 004

[1] Includes dross and skimmings as follows—1939: 30 tons, valued at $1,918; 1940: 356 tons, $21,815; 1941: 353 tons, $23,028; 1942: 3,214 tons, $150,913; and 1943: 5,032 tons, $216,941.
[2] In addition, manufactures of zinc imported as follows—1939: $1,545; 1940: $32; 1941: $1,099; 1942: $16; 1943: $35,255.
[3] Less than 1 ton.

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[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

EXPORTS

The value of exports of zinc ore and manufactured articles containing zinc of foreign and domestic origin (excluding galvanized products, alloys, and pigments) amounted to $19,322,462 in 1943 compared with $24,536,793 in 1942. Slabs, plates, or blocks continued to be the largest export group, but the total shipped to foreign countries decreased 27 percent—from 133,938 tons in 1942 to 97,439 tons in 1943. In addition to the items shown in the accompanying tables, considerable zinc is exported each year in brass, pigments, chemicals, and galvanized iron and steel. Export data on zinc pigments and chemicals are given in this volume in the chapter on Lead and Zinc Pigments and Zinc Salts. Much of the zinc used in the manufacture of such products is of foreign origin, and when they are exported a draw-back of 99 percent of the import duty is paid upon the basis of zinc contained in the finished product. Data covering 1943 draw-back were not available at the time of writing (June 24, 1944). Totals for preceding years were: 1942, 23,047 tons; 1941, 34,478 tons; 1940, 19,306 tons, and 1939, 16,216 tons.

Slab and sheet zinc exported from the United States, 1939–43, by destinations, in short tons

Destination	Slabs, plates, and blocks				Sheets, strips, or other forms, n. e. s.			
	1940	1941	1942	1943	1940	1941	1942	1943
Country:								
Argentina	890	862	67	....	579	504	210	91
Australia	....	....	....	(1)	246	464	558	48
Brazil	1,391	1,004	171	1,528	96	125	73	79
Canada	(1)	....	5,918	13,347	2,813	1,247	1,071	2,160
Chile	428	196	429	107	130	144	476	24
China	4,115	1,947	1,580	2,170	40	102	11	5
France	8,681	....	....	....	....	....	....	....
India and Dependencies	9,634	11,553	8,896	5,818	1,422	672	1,026	1
Japan	13,958	175	....	....	250	....	....	....
Mexico	....	400	110	161	....	311	207	196
U. S. S. R.	....	480	13,439	23,477	....	....	101	....
United Kingdom [2]	36,718	71,325	103,086	48,540	585	209	5	2
Other countries	3,276	1,367	242	2,291	1,320	1,468	1,029	561
Total	79,091	89,309	133,938	97,439	7,490	5,246	4,767	3,167
Continent:								
North America	268	433	6,073	13,509	3,127	1,721	1,490	2,387
South America	2,760	2,416	826	1,652	997	976	804	319
Europe	45,982	71,805	116,525	72,017	783	320	113	74
Asia	29,431	14,394	10,480	7,991	1,657	1,431	1,212	13
Africa	640	1	34	2,269	653	239	485	322
Oceania	20	260	....	1	273	559	663	52

[1] Less than 1 ton.

[2] United Kingdom of Great Britain and Northern Ireland.

Zinc ore and manufactures of zinc exported from the United States, 1939–43

Year	Zinc ore, concentrates, and dross (zinc content)		Slabs, plates, or blocks		Sheets, strips, or other forms, n. e. s.		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	303	$11,253	4,515	$479,338	6,708	$1,116,485	2,384	$468,516
1940	448	42,207	79,091	9,103,030	7,490	1,564,720	3,044	592,271
1941	....	....	89,309	12,712,121	5,246	1,328,516	2,901	676,876
1942	(1)	18	133,938	22,828,929	4,767	1,289,889	1,772	417,957
1943	1	305	97,439	17,167,729	3,167	891,132	5,859	1,263,296

[1] Less than 1 ton.

WORLD ASPECTS OF THE ZINC INDUSTRY

Although considerable information is available in 1943 with respect to wartime developments in zinc, for the most part these data are confined to countries in the Western Hemisphere. The continued dearth of pertinent information from many other important zinc-producing centers makes any estimates of world production and consumption unwarranted. The last estimate by the Bureau of Mines indicated a world mine production of 2,044,000 short tons (recoverable zinc content) in 1942, and it is doubtful if the output for 1943 was any greater, if as much. The total production from the United States, Canada, and Mexico, which represents more than half of the world output, was less in 1943 than in 1942. Canadian and Mexican gains were insufficient to offset a decline in production from the United States. Total production from South America—largely from Argentina, Bolivia, and Peru—remained much the same, but Australian production probably was less than in 1942. Under war conditions prevailing in Europe during 1943, it is assumed that output could hardly have increased in those countries. The zinc position of the United Nations was easy in 1943, and over-all production probably was greater than consumption.

World smelter production of zinc, 1938–43, by countries where smelted, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Australia	70,941	72,363	[2] 85,000	(3)	83,316	(3)
Belgium [4]	210,400	185,700	[2] 65,000	(3)	(3)	(3)
Canada	156,008	159,338	168,486	193,784	195,769	187,342
Czechoslovakia	8,876	(5)	(5)	(3)	(3)	(3)
France	60,560	60,262	[2] 35,000	(3)	(3)	(3)
Germany [6]	194,370	[7] 212,285	(7 8)	(3)	(3)	(3)
Indochina	4,470	5,439	[2] 6,700	(3)	[9] 4,647	(3)
Italy	33,637	33,566	[2] 40,000	(3)	(3)	(3)
Japan	[2] 50,000	(8)	[2] 55,000	[2] 65,000	(3)	(3)
Mexico	35,881	35,369	33,388	38,678	49,193	49,870
Netherlands	25,300	20,500	[2] 6,000	(3)	(3)	(3)
Northern Rhodesia	10,379	12,899	13,402	13,762	(3)	(3)
Norway	46,523	45,917	[2] 20,000	(3)	(3)	(3)
Poland	108,071	117,936	[2] 120,000	(3)	(3)	(3)
Spain	7,672	13,396	12,322	19,143	15,508	[10] 10,700
Union of Soviet Socialist Republics	[2] 80,000	(8)	(8)	(3)	(3)	(3)
United Kingdom [6]	56,190	50,440	[2] 60,000	(3)	(3)	(3)
United States	404,912	460,154	612,596	745,720	809,068	854,844
Yugoslavia	3,956	4,182	6,025	(3)	(3)	(3)
	1,568,000	1,635,000	1,643,000	(3)	(3)	(3)

[1] Statistical data derived in part from American Bureau of Metal Statistics, Yearbook.

[2] Estimate.

[3] Data not available.

[4] Includes 3,670 tons of electrolytic zinc in 1938. Data not available for later years. Production of electrolytic zinc began in August 1935.

[5] Included with Germany.

[6] Some secondary metal included.

[7] Includes Czechoslovakia.

[8] Estimate included in total.

[9] January to June, inclusive.

[10] January to August, inclusive.

REVIEW BY COUNTRIES

Argentina.—Mine production of zinc concentrate in 1943 was 37,185 metric tons, a decrease of 32 percent from the 54,642-ton output in 1942. The concentrate, nearly all of which is from the Aguilar mine, generally averages about 54 percent zinc. Of the substantial stock of concentrate on hand at the mine at the end of 1942, the greater part, if not all, was shipped to the United States during 1943.

Australia.—No figures have been published regarding Australian production, but mining activities were subject to critical labor shortages which hit the output of zinc and lead. Until April 1943 Mount Isa Mines, Ltd., continued to produce zinc concentrate and lead bullion, but for the remainder of the year output of these materials was curtailed in favor of copper production. On January 1, 1944, to balance the ever-changing demands of war, the Australian Government requested that production again be concentrated on zinc and lead rather than copper.

An extensive underground exploratory campaign by Lake George Mines, Ltd., at its property at Captain's Flat, New South Wales, reportedly has established an important lode. The ore, averaging 12 percent zinc and 8 percent lead, is concentrated by flotation.

The Electrolytic Zinc Co. of Australia reported a fairly even rate of production, although temporary reductions in output occurred due to interruptions in transporting zinc concentrate from the mainland. The lack of experienced labor slowed operations at the Tasmanian West Coast mines, and lack of materials set back the planned expansion of the electrolytic plant.

Bolivia.—Bolivia has become increasingly important as a zinc-producing country. Mine production of zinc in 1943 was 21,074 metric tons (zinc content in ore) compared with 10,909 tons in 1942, mostly from the Huanchaca mine. The Matilde mine near Lake Titicaca, owned and operated by the Compañía Hochschild, has been prospected and developed and reportedly contains an estimated 2,000,000 short tons of proved ore averaging 20 percent zinc, 24 percent lead, 1.6 ounces of silver per ton, and a trace of gold.

Brazil.—Little information is obtainable on the zinc industry of Brazil. A small production of electrolytic zinc was made in 1942 and 1943 by Companhia Brasileira do Zinco at a comparatively new plant at Utinga, near São Paulo, which has a reported capacity of 2 tons a day. The plant, which is expected to double its capacity, uses Bolivian ore.

Canada.—Production of zinc in Canada in 1943, including smelter production plus zinc contained in exported ore, amounted to 304,284 short tons (preliminary official figure), a gain of 5 percent above the 290,129-ton output in 1942. Of the total mine production, 55 percent was from British Columbia (mostly from the Sullivan mine), and the balance came largely from Quebec (21 percent), Saskatchewan (16 percent), and Manitoba (7 percent). Refined zinc production amounted to 206,510 tons (215,800 tons in 1942) from two electrolytic plants, one at Trail, British Columbia, operated by the Consolidated Mining & Smelting Co., Ltd., the other at Flin Flon, Manitoba, operated by the Hudson Bay Mining & Smelting Co., Ltd. Taxation continued to be high throughout the year, but despite this imposed burden new developments continued. The Aldermac Copper Corporation signed a contract late in 1943 for the sale of zinc, lead, and copper concentrates from its new mine near Sherbrooke, Quebec, to a United States smelter. It was reported that a 250-ton mill will be built, the mine and mill equipment to be transferred from the old company property in the Noranda district. A new company, the

Retallack Mines, Ltd., was organized to operate the Whitewater zinc-lead mine in the Slocan mining division. The disposal of the zinc (and lead) concentrates was reportedly arranged for through an agreement with the United States Commercial Co., a subsidiary of the Metals Reserve Co. In September the new mill of the New Calumet Mines, Ltd., started operating at the rate of 240 tons a day; the amount of ore is being increased to reach eventually the 500-ton per-day rated capacity. A Metals Reserve Co. contract for 70,000 tons of zinc and lead concentrates was negotiated.

Mexico.—Production of zinc in Mexico continued to advance in 1943, total production, in terms of zinc in ore plus smelter output, amounting to 197,199 metric tons compared with 189,278 tons in 1942 and 154,996 tons in 1941. Mining operations were conducted under generally favorable conditions, with no serious labor troubles in 1943. The threatened industry-wide walk-out at the end of 1942 carried over into the early part of 1943 but was finally avoided. Operating companies agreed to advances in wages for workers, who also obtained additional benefits resulting from the Presidential decree of September 23 which provided for a general wage increase to labor. The so-called Bateman-Suarez agreement was renewed early in 1943 for another year, the conditions of the agreement having proved mutually satisfactory and beneficial to both Mexico and the United States, which is the principal destination of Mexican exports. Unsatisfactory transportation facilities, both automotive and railroad, were one bad feature of the industry in 1943.

Newfoundland.—Mine production of zinc in 1943 amounted to 66,418 short tons (zinc content) compared with 56,202 tons in 1942. This 1943 tonnage was from 108,642 tons of 53-percent zinc concentrate (94,114 tons in 1942) and includes 8,874 tons of zinc contained in lead and copper concentrates (6,564 tons in 1943).

Northern Rhodesia.—Northern Rhodesia is the leading African producer of base metals, which come from ore deposits containing zinc, lead, and vanadium in the Broken Hill and Lusaka districts. The Rhodesian Broken Hill Development Co., Ltd., which operates the most important zinc mine in Africa, is reportedly installing a new mill and roasters to treat a substantial tonnage of rich zinc-lead sulfide ore recently developed. Mining has been largely confined to extensive reserves of oxidized zinc ore.

Peru.—Upon the basis of reports of the major zinc-producing companies, it has been estimated that 54,650 metric tons of concentrate containing 32,450 tons of zinc were produced in 1943 compared with 56,663 tons of concentrate containing 29,231 tons of zinc in 1942. The largest part of the zinc is derived from complex gold-silver-zinc-lead ore mined in the Department of Junin by the Cerro de Pasco Copper Corporation. That production by this company increased in 1943 was due in part to completion of the 800-ton daily capacity zinc concentrator. The electrolytic zinc pilot plant at Cerro de Pasco, which began production in 1940, reached the maximum annual capacity output of 1,200 metric tons of zinc by the end of 1943. Difficulties in obtaining supplies and power necessitated postponing the construction of the planned large-scale commercial electrolytic plant.

Among other factors influencing increased zinc production in 1943 were the construction of a 150-ton daily capacity zinc concentrator at

Cia Minera Atacocha, S. A., for the treatment of an estimated 100,000 tons of 14-percent zinc tailings and the beginning of zinc production in July at Cia Minera Yauli from a 100-ton daily capacity flotation plant. An agreement was signed on April 3, 1943, between the Volcan Mines Co. and Cerro de Pasco for the treatment of zinc ores from Volcan at the Mahr and Casapalca mills of Cerro de Pasco at an estimated rate of 300 short tons a day. Shipments of Volcan ore to the Mahr mill started in January 1944. Construction of a 500-ton-per-day concentrator at the Volcan mine—planned in 1943—was temporarily shelved. Installation of mining equipment was 50 percent complete at the close of 1943, but mine production is to increase in 1944 to at least 300 tons of ore a day.

Spain.—Output of zinc ore (concentrate?) in 1943 reportedly averaged 5,900 metric tons a month compared with 5,500 to 6,000 tons a month in 1942. The concentrate contains slightly more than 50 percent zinc. Production of zinc metal in 1943 was 1,400 metric tons a month (1,100 tons in 1942) according to estimates. Spain is self-sufficient in zinc, and normally a substantial quantity of concentrate is exported. Domestic consumption is increasing as greater amounts of zinc are being substituted for copper, which is in short supply.

Sweden.—It was reported that operations at a refinery in Trollhattan were to begin in the fall of 1943 with expected production to be about 5,000 metric tons a year. This refinery had been shut down since 1925, and Swedish ore was then sent to Belgium and Germany to be refined. Trollhattan also has another refinery that treats zinc dross and other wastes from galvanizing operations. Approximately 5,000 metric tons of such waste can be handled annually. By using the latest methods it is possible to recover nearly 100 percent of the zinc contained in the waste.

LEAD AND ZINC PIGMENTS AND ZINC SALTS

By H. M. Meyer and A. W. Mitchell

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GENERAL SUMMARY

There was substantial improvement in sales of lead and zinc pigments as a whole in 1943, following the 1942 recession from the high rates for 1941, and operations were generally at satisfactory levels. As in 1942, by far the larger part of the orders was to supply Government requirements. Producers were again hampered by the restrictions on supplies of linseed and other drying oils and of slab zinc, and by the limitations on supplies of containers. Curtailment in the use of linseed oil, dehydrated castor oil, and oiticica oil was eased late in 1943 and early in 1944, but producers were still forced to make considerable changes in their manufacturing practices in order to accommodate their Government and civilian customers as nearly as possible. As the year progressed the problem of maintaining adequate experienced workmen in the producing industry became more acute, and early in 1944 the trade reported that anticipated gains in civilian requirements were threatened by an increasing shortage of journeyman painters.

The paint, varnish, and lacquer trade established a new high record for sales by a narrow margin in 1943, according to data of the United States Department of Commerce covering 680 establishments that accounted for approximately 90 percent of the value of the industry as reported in the Census of Manufactures for 1939. The value of sales in 1943 was $568,620,999 compared with $529,745,027 in 1942 and the previous record of $555,398,819 for 1941.

In the first half of the year pigments producers were again able to obtain pig lead more readily than slab zinc, and this factor tended to improve the competitive position of the lead group. As demands for zinc oxide rose, however, and calls for the French process grade increased, manufacturers were permitted enough slabs to fill their essential requirements. With regard to the metals themselves, the supply-requirements position for zinc showed noteworthy improvement during the year, which led to record inventories of this metal at the year end. Supplies of lead from domestic mines and imports, on the other hand, receded from the quantities available for 1942 and failed, by a substantial margin, to equal requirements; as a result, total inventories declined. The situations described are due largely to the stricter Government controls on zinc because of the greater possibility of emergency war needs for this metal than for lead.

The production of titanium pigments failed to equal that in 1942 and in the peak year 1941, despite heavy demand. Sales were greater in 1943 than in 1942 but were below the high record established in 1941; they exceeded production in 1943, and stocks were substantially reduced during the year. The situation regarding titanium pigments supplies reversed itself in 1943. In the latter part of 1942 stocks increased, and the restrictions on titanium pigments were lifted in December. In 1943, on the other hand, the situation became increasingly critical, and Conservation Order M-353 (December 6, 1943) again imposed limitations on the titanium group.

The largest tonnage gain for pigments covered by this report was in the quantity of zinc oxide used for chemical warfare purposes, followed by the increase in the quantity of this same pigment used for rubber manufacture. Litharge consumption in rubber manufacture also rose in 1943. Consumption of pigments for storage-battery manufacture was higher than ever before. Agricultural use of litharge also reached new heights in 1943 and that of zinc sulfate is believed to have been exceeded only in 1942. Consumption of pigments in the manufacture of paint, the largest single use, was somewhat disappointing despite the increase in sales of red lead above the previous peak for 1942 and the rise in sales of zinc oxide for this purpose. Sales of white lead to paint makers dropped 14 percent below 1942 and were 32 percent less than the annual average for the 5-year period, 1935-39. Sales of lithopone and of leaded zinc oxide for this purpose also declined in 1943. For the most part in 1943 the ceramics industry took pigments at the reduced rates of 1942 or below.

An outstanding event of the war period has been the phenomenal growth in the use of zinc yellow as a nonferrous-metal primer. Two articles, published during the year, may be of interest.[1] Callahan said of this pigment "* * * In its contribution to the war effort, zinc chromate stands as the most important single pigment today. * * *" Only one company covered by the canvass of pigments (those that use ore, metal, and scrap) reported the output of zinc chromate as a final product. As other production of zinc chromate is from zinc oxide, it would duplicate the quantities of zinc oxide shown in this report.

The development, on a substantial scale, of zinc borate for use in paint finishes is worthy of note although, owing to the fact that it is reported by only one company, figures for this product also may not be shown. The principal use of zinc borate is in impregnating compositions to impart fire-retardant properties to camouflage netting and duck for military purposes.

On December 15, 1943, Simplified Practice Recommendation R144-43, for paints, varnishes, and related products, became effective.

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[1] Callahan, John R., Modernizing Chemical Color Manufacture: Chem. and Met. Eng., vol. 50 No. 6, June 1943, pp. 106-111.
Chemical Industries, Paint Progress: Vol. 53, No. 5, November 1943, p. 714.

Its purpose was to enable the industry to cooperate even more effectively in the war by further reducing the variety of colors. It had been accepted by a substantial percentage of the manufacturers and others concerned and was approved for promulgation by the United States Department of Commerce, through the National Bureau of Standards. The simplification program for limiting the variety of colors of paints, varnishes, and similar products to be manufactured and eliminating superfluous sizes of containers originally became effective in 1924, and the present revision is the fifth.

The container situation was recently described by Callahan.[2]

Three articles presenting several aspects of the paint situation were released in June 1943.[3]

Figures on pigments production in Canada indicate that on the whole 1942 marked a continuation of the advances noted in 1941 and that the industry operated at new record levels in that year; data for 1943 are not yet available. Zinc oxide and lithopone, however, dropped in 1942, leaded zinc and zinc leads making a particularly poor showing. The following statistics cover the quantities (in short tons) used in manufacturing in 1942 (1941 in parentheses): White lead (dry) 2,955 (2,164), white lead in oil 822 (714), basic sulfate white lead 74 (111), red lead 679 (648), litharge 809 (729), zinc oxide (pure) 1,211 (1,589), zinc oxide (leaded) and zinc leads 910 (2,255), lithopone

Salient statistics of the lead and zinc pigments industry of the United States, 1925–29 (average) and 1939–43

	1925–29 (average)	1939	1940	1941	1942	1943
Production (sales) of principal pigments:						
White lead (dry and in oil) short tons	154,483	98,429	80,562	113,000	83,639	76,167
Litharge do	84,845	89,518	89,841	122,280	91,513	113,091
Red lead do	41,362	39,976	42,200	53,838	48,369	53,378
Zinc oxide do	154,208	114,552	113,213	148,833	99,677	143,402
Leaded zinc oxide do	26,609	42,684	45,362	68,920	48,128	43,828
Lithopone do	177,745	142,759	151,802	176,642	137,320	135,723
Value of products:						
All lead pigments	$60,092,000	$35,485,000	$32,628,000	$46,572,000	$39,393,000	$41,897,000
All zinc pigments	41,314,000	28,794,000	28,747,000	39,210,000	30,785,000	36,260,000
Total	101,406,000	64,279,000	61,375,000	85,782,000	70,178,000	78,157,000
Value per ton received by producers:						
White lead (dry)	178	138	137	147	160	163
Litharge	176	123	126	134	150	152
Red lead	193	140	141	161	171	171
Zinc oxide	133	117	118	125	138	137
Lead zinc oxide	124	114	114	118	129	132
Lithopone	98	73	67	71	79	79
Foreign trade:						
Lead pigments:						
Value of exports	1,346,000	715,000	594,000	1,228,000	957,000	1,439,000
Value of imports	30,000	10,000	14,000	12,000	4,000	3,000
Zinc pigments:						
Value of exports	2,150,000	925,000	1,585,000	3,525,000	2,741,000	2,737,000
Value of imports	931,000	280,000	46,000	22,000	8,000	5,000
Export balance	2,535,000	1,350,000	2,119,000	4,719,000	3,686,000	4,168,000

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[2] Callahan, T. Pat, What the War has Taught Us About Containers: Chem. Industries, vol. 53, No. 5, November 1943, pp. 666-667.

[3] Totten, Maj. A. I., Jr., Paint as a Material of War: Paint Industry Mag., vol. 58, No. 6, June 1943, pp. 190, 192, 194. Lutz, John A., Suggestions for Conserving Oils in Civilian Paint Products: Pp. 194, 196, 198. Aldrich, Lt. H. L., New Navy Paint Specifications: Pp. 198–199.

9,911 (10,538), titanium white (pure) 2,084 (1,538), titanium pigments (reduced) 3,517 (2,948).

Late in 1943 the Zinc Pigment Development Association was formed by the leading British producers of zinc pigments. The stated purpose of the organization is to encourage and develop uses (actual and potential) of zinc pigments by all appropriate means, particularly by making their properties and applications more widely known and appreciated.

POST-WAR PROSPECTS

The pigments industry will undoubtedly share generously in the markets that mark reconversion of industry to peacetime pursuits and in the rehabilitation of the United States and the world after the war. An article by Trigg[4] on the return to peace conditions quotes an estimate of $16,070,000,000 per year of post-war construction and one of the United States Department of Commerce[5] that the entire paint industry could have a $740,000,000 year immediately after victory—a 61-percent increase over 1940 total sales. The F. W. Dodge Corporation estimated that total construction volume in 10 years following the war will average approximately double the average annual volume of the 1930–39 decade, which was a decade of depression and slow recovery. This would be an increase of about 5 percent over the prosperous 1920–29 decade, expressed in pre-war cost levels, the company stated. Trade estimates indicate that automobile manufacture after the war will average 50 percent over the pre-war rate, at least until the pent-up demand has been satisfied. The expected gains indicated above and those in the rubber and other industries that are large pigment consumers point to a higher rate of pigment consumption in the post-war period. The gains for the products covered by this report may not be distributed evenly, but it is safe to conclude that all or virtually all will contribute to the larger business. In the war years lead pigments have had a relatively greater share of the total market than zinc pigments, owing to conditions of easier supply of pig lead than of zinc slabs available for use of the pigments industry.

PRODUCTION

Sales in this report are taken as a better guide to activity in the pigments industry than production because complete data are not available on stocks and because materials classified as production of one item are sometimes sold under another description. Moreover, pigments produced under one classification at a plant are sometimes employed at a plant of another company for blending into another pigment in the lead and zinc group. The Bureau of Mines attempts to eliminate all possible duplication and to tabulate products only in the form in which they enter final use as pigments. Thus the quantities of basic lead sulfate and zinc oxide that are blended to make leaded zinc oxide are omitted, except as leaded zinc oxide. Duplication caused by other blending, which is on a considerably smaller scale, is also avoided insofar as possible. Pigments that are consumed by the producing companies, however, to make products beyond the ones covered by this report—that is, paint, storage batteries, and other articles—are considered as sales.

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[4] Trigg, Ernest T., Peace and the Painter: Paint Industry Mag., vol. 59, No. 4, April 1944, pp. 131-134.

[5] Hillhouse, F. B., Paint and its Post-War Prospect: Domestic Commerce, vol. 31, No. 25, December 1943, pp. 14, 22-23.

The total value of lead and zinc pigments in 1943 amounted to $78,157,000, a gain of 11 percent over 1942; except for 1941 it was the largest since 1929.

Lead pigments.—Red lead and litharge made the best showings of the pigments covered by this report, sales of red lead failing by a narrow margin to equal the peak rate for 1941 and those for litharge also being second only to those for 1941, dropping 8 per cent below that year. The poor record for white lead in recent years caused the lead pigments as a whole to fall below the zinc pigments in relation to the pre-war period, 1935–39. In 1943 the value of lead pigments was 29 percent higher than the average for the period 1935–39, compared with 35 percent for the zinc group. If white lead values were omitted from the totals, the gain in the lead pigments value for 1943 over the earlier period changes to 75 percent. The average values received by producers in 1943 showed slight gains, on the whole, over those for 1942. The advances were due to the somewhat higher prices that prevailed after the first month or two of 1942, which held throughout 1943. The average quotation for basic lead sulfate, on the other hand, was reduced in midyear 1942, and the revised quotation continued throughout 1943.

Lead pigments sold by domestic manufacturers in the United States, 1942–43

Pigment	1942			1943		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulfate or sublimed lead:						
White	7,229	$1,107,157	$153	4,752	$700,592	$147
Blue	1,181	191,811	162	845	126,102	149
Red lead	48,369	8,254,230	171	53,378	9,136,015	171
Orange mineral	128	30,643	239	79	19,736	250
Litharge	91,513	13,756,868	150	113,091	17,146,672	152
White lead:						
Dry	35,865	5,743,747	160	39,525	6,441,908	163
In oil [1]	47,774	10,308,863	216	36,642	8,326,458	227

[1] Weight of white lead only but value of paste.

Lead pigments sold by domestic manufacturers in the United States, 1939–43, in short tons

Year	White lead		Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1939	30,509	67,920	4,688	850	39,976	131	89,518
1940	30,115	50,447	5,493	707	42,200	137	89,841
1941	54,689	58,311	8,739	1,631	53,838	246	122,280
1942	35,865	47,774	7,229	1,181	48,369	128	91,513
1943	39,525	36,642	4,752	845	53,378	79	113,091

Zinc pigments and salts.—In the lead and zinc pigment groups zinc oxide had the largest tonnage and percentage gains in relation to 1942, surpassing the earlier year by 44 percent. In relation to other earlier years, however, red lead and litharge made more favorable showings. Demands for zinc oxide gained rapidly during the year, and in December it was placed under allocation, the terms of which are described in more detail under Zinc Oxide. Leaded zinc oxide sales continued to decline from the 1941 peak record, but they had not been exceeded before 1940. Lithopone sales were virtually the same in 1943 as in 1942, having fallen 1 percent. The average value received by producers for zinc oxide dropped $1.00 a ton, although there was no change in the price quotations for the lead-free grades from the beginning of 1942 throughout 1943. Price gains in the leaded variety after the first quarter of 1942, continuing throughout 1943, caused the producers' average value to rise. Lithopone quotations were unchanged from the beginning of 1942, and the average values of producers were identical.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1942–43

Pigment or salt	1942			1943		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	99,677	$13,746,599	$138	143,402	$19,712,413	$137
Leaded zinc oxide [1]	48,128	6,209,558	129	[2] 43,828	5,801,840	132
Lithopone	137,320	10,828,924	79	135,723	10,745,305	79
Zinc chloride, 50° B	52,374	2,789,430	53	53,707	2,670,432	50
Zinc sulfate	14,331	1,179,281	82	15,649	1,261,801	81

[1] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.
[2] Includes a small quantity containing less than 5 percent lead.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1939–43, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1939	114,552	42,684	142,759	(1)	10,157
1940	113,213	45,362	151,802	(1)	11,937
1941	148,833	68,920	176,642	(1)	19,201
1942	99,677	48,128	137,320	52,374	14,331
1943	143,402	[2] 43,828	135,723	53,707	15,649

[1] Data not available.
[2] Includes a small quantity containing less than 5 percent lead.

Sales of zinc chloride totaled 53,707 tons (50° B.) in 1943, an increase of nearly 3 percent over the quantity for 1942. These figures include the equivalent zinc chloride content of chromated zinc chloride and zinc ammonium chloride sold. Zinc sulfate sales in 1943 were second only to those for 1941, rising 9 percent above 1942.

CONSUMPTION BY INDUSTRIES

White lead.—Total white lead sales (dry and in oil) in 1943 were 9 percent below 1942; they were the smallest since 1933 and except for 1933 and 1932 the smallest since 1893. Dry white lead gained over 1942 and actually was larger than in any years other than 1941 and 5 years in the 1920's. The decrease for the "in oil" variety, therefore, was responsible for the poor showing for total white lead sales, both in relation to the record for 1942 and to that for many earlier years.

White lead is used mainly as a component of paint, 87 percent having been reported as sold for this purpose in 1943. A breakdown of the Other item would undoubtedly add to the paint classification.

Production of white lead totaled 61,129 tons.

Distribution of white lead (dry and in oil) sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paint	92, 380	73, 137	100, 665	76, 837	66, 441
Ceramics	1, 767	3, 029	3, 704	1, 812	1, 444
Other	4, 282	4, 396	8, 631	4, 990	8, 282
	98, 429	80, 562	113, 000	83, 639	76, 167

Basic lead sulfate.—Basic lead sulfate also is consumed mainly in paints, either directly as a pigment or indirectly through its use as an intermediate product in the manufacture of leaded zinc oxide. The totals shown for basic lead sulfate exclude the product used in blending. In 1943, 5,600 tons were sold for use in the manufacture of leaded zinc oxide.

Production of basic lead sulfate totaled 7,121 tons in 1943.

Distribution of basic lead sulfate sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paints	5, 170	5, 593	9, 285	7, 733	4, 802
Rubber	140	128	200	89	131
Storage batteries	4	4	8	------------	3
Other	224	475	877	588	661
	5, 538	6, 200	10, 370	8, 410	5, 597

Red lead.—Sales of red lead failed by a narrow margin to equal the peak rate established in 1941. In virtually duplicating the 1941 rate it made the best showing of the pigments covered by this report. As in 1942 and 1941, the high rate of consumption of red lead is due to its application as a construction paint, its use for paints having reached new heights in 1943, but its use in storage batteries (the principal outlet) was below that in 1940 and 1941. In 1943, 42 percent of the red lead sold was for paint, whereas in the 5-year period 1935–39 only 30 percent was destined for this purpose.

Production of red lead amounted to 53,495 tons in 1943 or to almost precisely the quantity of sales.

Distribution of red lead sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Storage batteries	24, 709	26, 718	27, 405	23, 545	26, 616
Paints	11, 421	11, 949	20, 130	21, 017	22, 271
Ceramics	1, 123	1, 117	1, 593	939	622
Other	2, 723	2, 416	4, 710	2, 868	3, 869
	39, 976	42, 200	53, 838	48, 369	53, 378

Orange mineral.—This is the smallest item, in tonnage, covered by the lead and zinc pigments canvass. Its principal use in recent years has been in the manufacture of ink. Sales in 1943 were the smallest on record since statistics for this product were first shown separately in 1889.

Only 3 tons of orange mineral were reported to have been produced in 1943.

Distribution of orange mineral sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Ink manufacture	64	51	98	93	49
Color pigments	40	18	26	7	8
Other	27	68	122	28	22
	131	137	246	128	79

Litharge.—Sales of litharge in 1943 were 24 percent above 1942 and second only to the record for 1941, being 8 percent below that year. This favorable showing was surpassed only by that for red lead, among the pigments covered by this report. The quantities used in storage batteries are well above double those for the next most important class, and in 1943 the quantity so used was greater than in any previous year. In addition to the litharge used to make batteries, the storage-battery manufacturers themselves produce a black or suboxide of lead which they use as a substitute for litharge. In 1943, 60,000 tons of black oxide were produced, or only slightly below the 1941 record of 61,000 tons. These quantities required the use of 57,000 and 58,000 tons, respectively, of pig lead. Black oxide figures are not included in the Bureau of Mines totals for litharge. The consumption of litharge for insecticides in 1942 was considerably under the amounts so used in several previous years. In 1943, however, it surpassed the former peak record for 1941 by 4 percent. Sales for ceramics, chrome pigments, oil refining, and rubber were all above the previous year, but all except rubber were notably below 1941. Sales for chrome pigments manufacture gained 27 percent over 1942, and those for rubber were up 24 percent and the largest since 1930. Litharge sales to varnish makers were at a relatively unchanged rate from 1942.

Production of litharge (112,037 tons in 1943) failed to equal sales by roughly 1,000 tons.

Distribution of litharge sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Storage batteries	39, 754	38, 303	49, 847	43, 630	54, 984
Insecticides	16, 435	16, 041	19, 403	14, 830	20, 236
Ceramics	8, 679	12, 072	18, 285	9, 525	9, 866
Chrome pigments	9, 415	8, 456	13, 927	7, 344	9, 351
Oil refining	7, 619	6, 876	6, 749	4, 771	5, 227
Rubber	1, 404	1, 590	3, 968	3, 460	4, 302
Varnish	2, 428	3, 003	3, 165	3, 423	3, 453
Linoleum	226	418	647	343	98
Other	3, 558	3, 082	6, 289	4, 187	5, 574
	89, 518	89, 841	122, 280	91, 513	113, 091

Zinc oxide.—This pigment made the largest gain in 1943 of any of the products covered by this report. The increase was partly a reaction from the severe drop in 1942, which had been dictated in part by stringent supplies of zinc metal and scrap and by the uncertainties in connection with the prospective consumption of zinc oxide by the synthetic rubber industry. The main part of the rise in zinc oxide sales was the quantity of pigment used for making smoke mixtures for chemical warfare. Consumption of zinc oxide in the manufacture of rubber—the largest use—increased 29 percent in 1943 and that in paints—second in importance—was 19 percent higher than in 1942. Floor coverings and textiles took 27 percent more zinc oxide in 1943 than in 1942, but the quantity so taken did not show up to advantage in comparison with several years before 1938. The ceramic industry's use of zinc oxide rose in 1943 against the trend for other pigments consumed for this purpose.

Zinc oxide makers were hampered in the first half of the year by their inability to obtain adequate supplies of slab zinc for the manufacture of French-process grades. As the year progressed, however, and demands for zinc oxide increased, the War Production Board released all required metal to the producers.

Production of lead-free zinc oxide amounted to only 123,913 tons, or over 19,000 below sales. Of the total, 101,898 tons were produced by the American process almost entirely from ores or primary residues, 17,844 tons by the French process from metal or scrap, and 4,171 tons by other processes—largely from scrap materials.

On September 13, General Preference Order M-11-A was amended to prevent producers of lead-free zinc oxide from shipping any of their product not previously set aside, as ordered, except (1) to fill orders rated AA-5 or higher, (2) to a person certifying that his stocks and supplies from all sources would be less than 1 ton, or (3) except as otherwise specifically authorized in writing by the War Production Board. On December 29 lead-free zinc oxide was placed under allocation control in a rewriting of Order M-11-A, which listed 26 permitted uses. Deliveries of 2 tons or less could be accepted, under provisions of the order, without obtaining specific authorization of the Board, but only for the uses listed in the revised order.

Distribution of zinc oxide sales, 1939-43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Rubber	70, 187	70, 979	90, 429	52, 717	67, 898
Paints	25, 334	23, 268	30, 304	25, 122	29, 852
Chemical warfare	----	----	----	----	21, 801
Floor coverings and textiles	5, 641	4, 752	6, 991	5, 224	6, 633
Ceramics	6, 572	6, 352	8, 596	2, 934	3, 203
Other	6, 818	7, 862	12, 513	13, 680	14, 015
	114, 552	113, 213	148, 833	99, 677	143, 402

Leaded zinc oxide.—Sales of leaded zinc oxide declined 9 percent in 1943 following the more severe drop of 30 percent in 1942 from the peak rate for 1941. Despite the decreases mentioned, leaded zinc oxide sales for 1943 had not been exceeded before 1940. It is used almost exclusively in the manufacture of paint. The figures for leaded zinc oxide include basic lead sulfate used in blending as indicated under Basic Lead Sulfate.

Leaded zinc oxide sales in 1943 were 11 percent above the production of 39,515 tons. Of the output, 19,235 tons contained over 5–35 percent lead, 16,611 tons 35–50 percent, and most of the remainder more than 50 percent.

Distribution of leaded zinc oxide sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paints	41,519	44,341	67,472	47,052	42,303
Rubber	1	....	1	....	42
Other	1,164	1,021	1,447	1,076	1,483
	42,684	45,362	68,920	48,128	43,828

Lithopone.—The lithopone statistics in this report are given upon the basis of ordinary lithopone sold as such plus the ordinary lithopone content of the high-strength product. This method of publication is used to conceal the operations of one company which always dominates the output of the high-strength product and is the only producer in some years. Three plants and two companies were involved in high-strength lithopone production in 1943. There was little change in the rate of sales of lithopone in 1943; sales in 1942 and 1943, however, were 33 and 34 percent, respectively, below the peak record in 1929. By far the largest part of sales of lithopone is for the manufacture of paints, 77 percent of the total having been for that purpose in 1943 and 80 percent in 1942. Sales for this purpose fell 5 percent compared with 1 percent for total sales. Floor coverings and textiles take the second largest amounts, but they employed only 11 to 12 percent of the totals for the 2 years. This use gained 1 percent in 1943 but was 14 percent lower than the average for the 10-year period ended 1941. Based upon somewhat incomplete information, separation of the 1943 quantities shown in the following table for floor coverings and textiles indicates that 11,900 tons were used for linoleum and felt-base floor coverings and the remainder for coated fabrics and textiles (oilcloth, shade cloth, artificial leather, and similar products). Other sales in 1943 included 4,043 tons for paper and 1,137 tons (incomplete) for printing ink. Paper gained 18 percent in 1943 and ink 105 percent. Figures for an additional quantity of printing ink cannot be separated from the totals for paint. The principal item under Other uses covers exports. One company, at least, has classified part of its exports according to the end use so that the Other class is too small to cover total exports.

Plant capacity for the production of lithopone was reported to total 157,000 tons, a drop from 182,000 reported for 1942. The drop is explained chiefly by the closing of lithopone operations at the plant of the United Color & Pigment Co. in Newark, N. J. The company reported that the plant was being dismantled early in 1944.

Production of lithopone totaled 132,621 tons in 1943.

Distribution of lithopone sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Paints, etc.	113,995	[1] 117,075	[1] 132,691	[1] 109,216	[1] 103,860
Floor coverings and textiles	17,429	18,738	21,114	15,775	15,999
Rubber	3,189	3,387	3,547	1,047	1,078
Other	8,146	12,602	19,290	11,282	14,786
	142,759	151,802	176,642	137,320	135,723

[1] Includes a quantity, not separable, used for printing ink.

The consumption of ordinary-strength lithopone in the manufacture of titanated lithopone (which usually contains about 15 percent TiO_2) amounted to only 8,400 tons in 1943 or to considerably less than half of the record tonnage of 19,400 tons for 1937. This use of lithopone has trended downward almost continuously since the peak was reached. Lower production by the United Color & Pigment Co., mentioned in the preceding paragraph, was chiefly responsible for the drop in 1943. The lithopone figures in the following table are included in the totals for ordinary lithopone in the preceding table.

Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1939–43, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1939	16,100	13,700	1942	11,700	9,900
1940	18,100	15,200	1943	9,800	8,400
1941	16,800	14,100			

Zinc sulfide.—Only one company produced zinc sulfide in 1943 and in 1942, therefore it is not possible to publish totals for this product.

Zinc chloride.—Sales of zinc chloride, in terms of 50° B. solution, totaled 53,707 tons in 1943 compared with 52,374 tons in 1942—a gain of 3 percent. These figures include the zinc chloride equivalent of zinc ammonium chloride and of chromated zinc chloride produced. Comparable data for recent earlier years and complete figures showing distribution of sales by uses are not available.

Zinc sulfate.—Sales of zinc sulfate gained 9 percent in 1943 and were second only to those for 1941, being 18 percent below that record total, however. Rayon resumed its place as the leading use in 1943, having been supplanted by agriculture in 1942 and by chemicals in 1941. A further break-down of the chemical classification, however, probably would add tonnage to several of the groups. Rayon sales increased 44 percent in 1943 and have been exceeded only by those in 1941. The agricultural use has been taking increasing quantities of zinc sulfate, reaching a peak in 1942 from which it dropped 19 percent in 1943. The feature of sales in 1943 was the gain in the quantity for paint and varnish processing. This class gained 27 percent in 1943 to its second successive peak and represented 16 percent of total sales; in 1936 and 1937 it accounted for only 1 and 2 percent, respectively. The chemical class dropped 37 percent in 1943, following a severe decline in 1942. These changes probably indicate that a more precise break-down of end-use information has been possible.

Distribution of zinc sulfate sales, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Rayon	3,897	3,649	5,170	3,149	4,537
Agriculture	2,168	2,366	3,038	4,123	3,329
Paints and varnish processing	583	1,509	1,422	1,917	2,439
Chemicals	1,309	2,151	5,555	2,595	1,642
Flotation reagent	266	241	312	355	1,282
Glue	172	320	1,203	750	635
Textile dyeing and printing	----------	54	130	60	213
Electrogalvanizing	556	348	502	219	187
Other	1,206	1,299	1,869	1,163	1,385
	10,157	11,937	19,201	14,331	15,649

RAW MATERIALS USED IN MANUFACTURE OF LEAD AND ZINC PIGMENTS AND ZINC SALTS

The schedules for compiling statistics on lead, zinc, and lead and zinc pigments and salts in 1943 were changed from those for earlier years to obtain more precise information regarding sources of crude materials used and more data on end products. As a consequence, the figures ordinarily presented in this section of the report on lead and zinc pigments will be no longer available in their previous form. Figures covering lead and zinc in ore and metal and scrap used in making total pigments should be available later in the year and will be released to the public at that time.

PRICES

The total and average values reported by producers for lead and zinc pigments are given in the tables in the first part of this report. Except for basic lead sulfate, average values for lead pigments in 1943 were either the same as in 1942 (as in the case of red lead) or higher by $2 to $11 a ton. In the main the gains were due to the general rise in prices for lead pigments during the first 2 months of 1942, after which quotations were unchanged throughout the remainder of the year and through all of 1943. The rise in quotations for litharge came later in 1942 than the others. The white variety of basic lead sulfate was quoted at 7¾ cents a pound for 3½ months in 1942 but did not go above 7½ cents in 1943; the average value for this product declined in 1943, contrary to the record for other lead pigments.

Prices for pig lead were unchanged throughout 1943 at the levels established by the Office of Price Administration ceiling limitations in January 1942. The ceiling price for common lead, delivered New York, was 6.50 cents a pound. Corroding and chemical grades were allowed premiums of 0.10 cent a pound. The chemical grade, however, was quoted throughout 1943 at 0.05 cent below the ceiling, both at New York and at St. Louis. Ordinarily lead-pigment prices follow closely the price movements in pig lead.

Except for the grades of zinc oxide containing 35 percent or more lead, there were no changes in zinc pigment quotations from the first of 1942 throughout 1943. Leaded zinc oxide values received by producers gained an average of $3 a ton in 1943, whereas the lead-free grade dropped $1 and lithopone was unchanged.

As a rule the relationship between zinc pigment quotations and those for slab zinc are not as close as that among the lead classes. This situation is due largely to the fact that much ore is used directly in the manufacture of zinc pigments, whereas pig lead is the source of most of the lead pigments produced.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1940–43, in cents per pound

Product	1940	1941	1942	1943
Basic lead sulfate, or sublimed lead, less than carlots, barrels	6.25- 6.75	6.50- 7.00	7.00- 7.75	7.50- 7.75
White lead, or basic lead carbonate, dry, carlots, barrels	7.00- 7.50	7.50	7.50- 8.25	8.25
Litharge, commercial, powdered, barrels	6.25- 8.25	7.00- 8.25	7.35- 9.00	8.00- 9.00
Red lead, dry, 95 percent or less, less than carlots, barrels	7.75- 9.25	8.50- 9.25	8.75-10.00	9.50-10.00
Orange mineral, American, small lots, barrels	10.25-11.75	11.00-11.75	11.25-12.50	12.00-12.50
Zinc oxide:				
American process, lead-free, bags, carlots	6.25- 7.50	6.50	7.25	7.25
American process, 5 to 35 percent lead, barrels, carlots	6.25- 6.75	6.25- 6.75	7.00- 7.38	7.25- 7.38
French process, red seal, bags, carlots	7.50- 7.75	7.75	8.50	8.50
French process, green seal, bags, carlots	8.00- 8.25	8.25	9.00	9.00
French process, white seal, barrels, carlots	8.75- 9.00	9.00	9.75	9.75
Lithopone, ordinary, small lots, bags	3.85- 4.00	4.10	4.50	4.50
Zinc sulfide, less than carlots, bags, barrels	7.75- 8.00	8.00- 8.25	8.50- 8.75	8.50- 8.75
Zinc chloride, works:				
Solution, tanks	2.25	2.25- 2.50	2.50	2.50
Fused, drums	4.25- 5.75	4.25- 6.50	5.00- 6.50	5.00- 6.50
Zinc sulfate, crystals, barrels	2.90- 3.90	3.15- 4.40	3.65- 4.60	3.85- 4.60

FOREIGN TRADE [6]

As usual, all of the important items in foreign trade in lead and zinc pigments and salts were in the export classification in 1943. The chief value in imports covered zinc sulfate, and its value represented well over half of the import total. Even for this item the balance was strongly in favor of exports, and all other items covered showed export excesses. Lithopone, as usual, was the chief export class in point of tonnage in 1943, and it was followed by zinc oxide, white lead, litharge, and red lead. The exports of no item other than lithopone represented as much as 10 percent of domestic sales and of only white lead as much as 5 percent of domestic sales. Except for the items specified, foreign trade in lead and zinc pigments and zinc salts has little significance. The total value of lead pigments exported rose 50 percent in 1943, but that for the zinc group was relatively unchanged. Value of the two classes plus that for lead and zinc salts gained 19 percent in 1943.

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[6] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1942–43

	1942		1943	
	Imports	Exports	Imports	Exports
Lead pigments:				
White lead		$392,812		$844,992
Red lead	$182	257,921	$492	314,771
Litharge	432	289,940	574	266,839
Orange mineral		1,887		2,102
Other lead pigments	3,221	14,600	2,283	10,443
	3,835	957,160	3,349	1,439,147
Zinc pigments:				
Zinc oxide	6,128	1,001,248	4,821	1,070,286
Lithopone		1,733,698		1,637,217
Zinc sulfide	1,677	6,328		29,523
	7,805	2,741,274	4,821	2,737,026
Lead and zinc salts:				
Lead arsenate		73,312		375,465
Other lead compounds	2,006	(1)		(1)
Zinc chloride		42,674		57,390
Zinc sulfate	18,585	53,624	29,212	81,750
Other zinc salts and compounds	(1)	76,023	(1)	22,087
	20,591	245,633	29,212	536,692
Grand total	32,231	3,944,067	37,382	4,712,865

[1] Data not available.

Lead pigments and salts imported for consumption in the United States, 1939–43

Year	Short tons					Total value
	Basic carbonate white lead	Red lead	Litharge	Orange mineral	Lead compounds	
1939	11	2		1	104	[1] $28,248
1940	2		(2)	1		[1] 13,969
1941	2	3			17	[1] 15,367
1942		2	2		11	[1] 5,841
1943		4	1			[1] 3,349

[1] Includes also—1939: Lead pigments, n. s. p. f., $690 (5,270 pounds), and suboxide of lead, n. s. p. f. $6,620 (40,445 pounds); 1940–43: Suboxide of lead, n. s. p. f., as follows—1940: $13,571 (71,148 pounds); 1941: $11,694 (65,268 pounds); 1942: $3,221 (13,228 pounds); 1943: $2,283 (6,614 pounds).

[2] Less than 1 ton.

Lead pigments and salts exported from the United States, 1939–43

Year	Short tons						Total value
	White lead	Red lead	Litharge	Orange mineral	Sublimed lead	Lead arsenate	
1939	2,024	1,324	2,077	(1)	(1)	856	$875,235
1940	1,360	1,336	1,586	(1)	(1)	1,450	836,230
1941	2,901	2,966	2,892	(1)	(1)	4,707	2,100,335
1942	2,249	1,391	1,999	7	95	296	1,030,472
1943	4,692	1,535	1,610	7	71	1,527	1,814,612

[1] Not compiled on an annual basis before 1942.

Zinc pigments and salts imported for consumption in the United States, 1939–43

Year	Short tons						Total value
	Zinc oxide		Lithopone	Zinc sulfide	Zinc chloride	Zinc sulfate	
	Dry	In oil					
1939	1,485	66	2,641	7	399	325	$317,719
1940	273	45	------------	(1)	19	245	54,923
1941	122	11	(1)	1	------------	162	29,835
1942	13	1	------------	1	------------	362	26,390
1943	10	11	------------	------------	------------	546	34,033

[1] Less than 1 ton.

Zinc pigments and salts [1] exported from the United States, 1939–43

Year	Short tons		Total value	Year	Short tons		Total value
	Zinc oxide	Lithopone			Zinc oxide	Lithopone	
1939	3,485	4,845	$925,468	1942	6,013	17,036	[2] $2,913,595
1940	3,239	14,298	1,584,667	1943	6,019	17,320	[2] 2,898,253
1941	8,264	21,527	3,525,386				

[1] Zinc salts not separately recorded on an annual basis before 1942.

[2] Includes also—1942: Zinc sulfide $6,328 (37,691 pounds); zinc chloride, $42,674 (648,343 pounds); zinc sulfate, $53,624 (1,025,554 pounds); other zinc salts and compounds, $76,023 (519,458 pounds); 1943: Zinc sulfide, $29,523 (78,387 pounds); zinc chloride $57,390 (751,861 pounds); zinc sulfate $81,750 (1,830,508 pounds); ether zinc salts and compounds, $22,087 (139,940 pounds).

GOLD, SILVER, COPPER, AND LEAD IN ALASKA

(MINE REPORT)

By CHAS. W. HENDERSON AND R. V. CUSHMAN

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SUMMARY

The production of gold in Alaska made a poor showing in 1943. The gold recovered from ores and gravels totaled only 99,583 fine ounces valued at $3,485,405, a decrease of 80 percent from the 1942 production and the lowest quantity mined in the Territory since 1897. The value of the gold in 1943 was 98 percent of the total gross value of the gold, silver, copper, and lead produced. The primary reason for this marked decrease in gold output was the War Production Board Gold Mining Limitation Order L–208 of October 8, 1942, the full effect of which was not felt in Alaska until 1943. Only 7 of the 47 available floating connected-bucket dredges were in operation during the year. These dredges were allowed to work under limited reprieves granted with the provision that only men over draft age and not qualified for any type of war work be employed. One dry-land dredge was in operation in 1943; nearly all earth-moving equipment was disposed of to contractors on Government military projects. Out of the 38 lode mines in operation in 1942, only 8 were active in 1943, but these 8 mines supplied 58 percent of the gold and 88 percent of the silver produced in the Territory. The Alaska Juneau Gold Mining Co. at Juneau was by far the largest producer.

One other important reason for the decrease in the gold output in Alaska in 1943 was the serious shortage of labor at the mines, created by the high wages offered laborers on the numerous Army and Navy construction projects throughout the Territory. A large percentage of the mining in 1943 was carried on by men who, for various reasons, could not work in essential war activities.

The regulations on gold mining were eased slightly by the War Production Board during 1943 to give relief to some of the small placer gold-mine operators in the Territory. The Gold Mining Limitation Order L–208, as originally issued on October 8, 1942, closed down all "nonessential" mines except those lode mines that produced 1,200 tons or less of commercial ore in 1941 (provided the rate of production of such mines did not exceed 100 tons per month), and those placer mines that treated less than 1,000 cubic yards of material in 1941 (provided that the rate of treatment of such placer mines did not exceed 100 cubic yards per month). The order was first amended in the Territory of Alaska in the spring of 1943 to permit small placer-gold mines that employed five men or less (including the owner and associates) to resume operations. The permits granted under this amendment were restricted to the 1943 season. A new grant issued later in the year permitted the employment of seven men instead of five and extended the time limit to an indefinite period. The essential provisions of the permits are as follows:

(*a*) That not more than seven men, including the owner and associates, are actively engaged in the operation.

(*b*) That not more than one of those men, who must be either the owner or supervisor, was residing outside the Territory of Alaska at the date of the issuance of this grant.

(*c*) That no men shall be employed unless, because of age, physical handicaps, or other reasons, they cannot be used in essential war activities.

(*d*) That no critical materials, other than those in the possession of the operator, or available second-hand, will be required.

A bright spot in the future for Alaska mining is the many highways and airfields that have been and are now being built to connect various parts of the Territory. All these new units promise to be especially useful to the mining industry.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

The following tables show the mine production of gold, silver, copper, and lead in Alaska in 1939–43 and 1880–1943, in terms of recovered metals; the output of gold and silver in 1943, by types of operation; and the output of gold, silver, copper, and lead from amalgamation and cyanidation mills (with or without concentration equipment) in 1943, by regions.

Mine production of gold, silver, copper, and lead in Alaska, 1939–43, and total, 1880–1943, in terms of recovered metals

Year	Gold (lode and placer)		Silver (lode and placer)	
	Fine ounces	Value	Fine ounces	Value
1939	676,737	$23,685,795	201,054	$136,473
1940	755,970	26,458,950	191,679	136,305
1941	695,467	24,341,345	191,522	136,193
1942	487,621	17,066,735	119,704	85,123
1943	99,583	3,485,405	42,788	30,427
1880–1943	25,739,234	613,887,792	19,725,160	14,031,221

Year	Copper		Lead		Total value
	Pounds	Value	Pounds	Value	
1939	256,000	$26,624	1,874,000	$88,078	$23,936,970
1940	110,000	12,430	1,558,000	77,900	26,685,585
1941	144,000	16,992	1,324,000	75,468	24,569,998
1942	44,000	5,324	830,000	55,610	17,212,792
1943	54,000	7,020	400,000	30,000	3,552,852
1880–1943	[1] 685,857	226,561,326	[1] 24,756	2,740,631	857,220,970

[1] Short tons.

Mine production of gold and silver in Alaska in 1943, by types of operation, in terms of recovered metals

Type of operation	Mines producing	Material treated	Gold			Silver			Total value
			Fine ounces	Percent of total		Fine ounces	Percent of total		
				1943	1942		1943	1942	
Lode mines	8	[1] 1,483,527	57,472	58	28	37,686	88	57	$2,038,319
Floating connected-bucket dredges	7	[2] 1,458,059	18,554	19	51	2,084	5	29	650,872
Dry-land dredges	1	[2] 66,400	1,530	1	[4] 21	146	([3])	[4] 14	53,654
Hydraulic placers	46	[2] 448,700	8,872	9		1,204	3		311,376
Placers (drift mining, sluicing, etc.)	[5] 60	([6])	13,155	13		1,668	4		461,611
	122		99,583	100		42,788	100		3,515,832
Total, 1942	491		487,621		100	119,704		100	17,151,858

[1] Short tons of ore.
[2] Cubic yards of gravel.
[3] Less than 0.5 percent.
[4] Figures for break-down by type of operation not available.
[5] Includes all other types and sizes of placer operations.
[6] Figures not available.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Alaska in 1943, by regions, in terms of recovered metals

Region	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Cook Inlet–Susitna	16,280	11,387	673	282	1,692	175	1,900	
Southeastern Alaska	1,462,364	32,836	8,647	851	7,866	27,092	16,292	400,000
Yukon River Basin	3,000	3,400	721	35	161	141		
	1,481,644	47,623	10,041	1,168	9,719	27,408	18,192	400,000
Total, 1942	2,814,884	115,304	21,928	2,862	21,968	45,372	41,837	800,209

Gold.—Floating connected-bucket dredges recovered only 19 percent of the total Alaska output of gold in 1943, compared with 51 percent in 1942; only seven dredges operated during the year. Placer mines worked by dragline and dry-land dredges, bulldozers, hydraulic giants, drifting, and sluicing together yielded 23 percent of the total gold in 1943 compared with 21 percent in 1942; the larger producing districts from these types of operations were the Kougarok, Iditarod, Yentna-Cache Creek, and Fairhaven. Lode mines contributed 58 percent of the total Alaska output of gold in 1943 compared with 28 percent in 1942. The Alaska Juneau Gold Mining Co. was again the largest producer of lode gold in Alaska. This property operated at greatly reduced capacity. Its continuance was allowed partly in expectation of handling chromite but mainly because of its importance to the life of the town of Juneau.

Silver.—All the silver produced in Alaska in 1943 was a byproduct of gold mining.

Copper.—About 78 percent of the copper recovered in Alaska in 1943 came from dry and siliceous ores.

Lead.—All the recovered lead output of Alaska in 1943 came from lead concentrates produced at the flotation mill of the Alaska Juneau Gold Mining Co.

MARKETS AND METALLURGY

About 96 percent of the gold and 38 percent of the silver produced from Alaska ores and gravels in 1943 were obtained in the form of gold-silver bullion, virtually all of which was sold finally to the Seattle Assay Office. As there were no smelters or refineries in Alaska, most of the remaining gold and silver produced and all of the lead and copper were obtained from high-grade ore and concentrates shipped to two smelters in the States, namely, the Tacoma (Wash.) and Selby (Calif.) smelters owned and operated by the American Smelting & Refining Co. The two smelters recovered 11 percent of the gold and 67 percent of the silver produced in 1943. The largest private purchasers (or agents) of gold-silver bullion in the Territory and in Seattle, Wash., in 1943 were: The Bank of Fairbanks and the First National Bank of Fairbanks, Fairbanks; the Miners & Merchants Bank of Alaska, Nome; the Miners & Merchants Bank of Iditarod, Flat; the Wiseman Trading Co., Wiseman; the Northern Commercial Co. and the Seattle-First National Bank, Seattle, Wash. The bullion purchased was either sent direct to the Seattle Assay Office or cast into bars for shipping; in many instances the banks acted merely as agents for the lode and placer operations.

Ore-dressing mills active in Alaska in 1943 included the 12,000-ton Alaska Juneau amalgamation-table concentration-flotation mill and five other mills, most of which were amalgamation-flotation plants. With the exception of the Alaska Juneau, no mill had a daily capacity of over 75 tons. Shipments of concentrates from amalgamation or cyanidation mills having concentrating equipment averaged 8.32 ounces of gold and 23.47 ounces of silver to the ton; concentrates from straight concentration mills averaged 2.36 ounces of gold and 3.94 ounces of silver to the ton. All the lead concentrates produced in

1943 were obtained from concentration by flotation of the dry gold ore of the Alaska Juneau Gold Mining Co. property at Juneau.

The United States Assay Office at Seattle, Wash., reports the following receipts from Alaska in 1943.

Bullion of Alaska origin deposited at United States Assay Office, Seattle, Wash., during year ended Dec. 31, 1943, in fine ounces

Region	Gold	Silver	Region	Gold	Silver
Cook Inlet-Susitna	16,271	904	Seward Peninsula	16,986	2,094
Copper River	259	32	Southeastern Alaska	35,019	9,121
Kenai Peninsula	55	12	Yukon River Basin	24,501	3,816
Kuskokwim	2,483	191			
Northwestern Alaska	4	----------		95,578	16,170

REVIEW BY REGIONS

Cook Inlet-Susitna region.—This region, which includes the Iliamna, Valdez Creek, Willow Creek, and Yentna-Cache Creek districts, produced 23 percent of the total gold output from lode mines in Alaska in 1943. There was only one producing lode mine in the region compared with 7 in 1942 and 10 in 1941. In the relative order of their total production the districts rank as follow: Willow Creek, Yentna-Cache Creek, Valdez Creek, and Iliamna.

The Willow Creek district, north of Wasilla at the head of Cook Inlet, was in 1943 again the second-largest lode-gold producing district in Alaska. The entire output of the district came from the Independence and Free Gold mines near the head of Fishhook Creek, operated by the Alaska-Pacific Consolidated Mining Co. The mine is equipped with a 75-ton amalgamation-flotation mill and 100-ton sorting plant and was operated continuously until August 8, 1943, at which time the mine and mill were closed down and put in a stand-by condition in compliance with a War Production Board order. The mine produced 16,280 tons of ore during 1943, averaging 0.90 ounce of gold per ton.

The Yentna–Cache Creek district, which includes the area west of the Susitna River drained by the Yentna River and its tributaries, was the largest producer of placer gold in the region. In general, the productive placer creeks are tributaries of Peters, Cache, or Granite Creeks. Six properties operated during the year, all using hydraulic giants to recover gold from stream and bench gravels. The largest producers were the Cache Creek Mining Co. on Cache Creek and Edward Wagner on Bird Creek.

In the Valdez Creek district, which lies north of Anchorage near the head of the Susitna River, Carlson & Associates operated a hydraulic outfit on the Folk bench claim on Valdez Creek. This was the only operation in the district in 1943.

There was no mining in the Iliamna district in 1943.

Copper River region.—The Copper River region includes the Chistochina, Nelchina, Nizina, Prince William Sound, and Yakataga (including Icy Bay) districts. There was no production from the Chistochina, Nelchina, and Prince William Sound districts in 1943.

In the Nizina district two producing mines operated in 1943. The Dan Creek Placer Mines, Inc., did not operate its hydraulic placer mine on Dan Creek 25 miles east of McCarthy in 1943 but did ship 8 tons of crude native copper, which averaged 78 percent copper, to the Tacoma (Wash.) smelter. This was part of a mass of native copper which was found on the property in 1939. The only producer of placer gold in the district was the Chititu Mines Co. operating on bench ground in Rex Gulch, a tributary of Chititu Creek. Four 3-inch Fisher hydraulic giants moved approximately 14,000 cubic yards of gravel, recovering 141.46 ounces of bullion with an average fineness of 0.905 in gold and 0.089 in silver.

Beach gravels and sands, worked by two sluicing operations, yielded the only gold and silver produced in the Cape Yakataga district.

Kenai Peninsula region.—The Kenai Peninsula region includes the Moose Pass-Hope, Nuka Bay-Homer, and Turnagain Arm-Girdwood districts. In 1943 the only production of gold and silver from the region came from one small placer operation in the Nuka Bay-Homer district.

Considerable work has been done in this district in the development of the chromite mines in the Red Mountain area about 10 miles southeast of Seldovia at the south end of Kenai Peninsula. The Chromite Queen Mining Co. operated the Chromite Queen mine in 1943. Part of the ore was shipped to the Metals Reserve Co. stock pile at Seldovia, which was established in 1943 for that purpose. The Red Mountain Chromite, Inc., is developing its mine at Red Mountain, but ore shipments are held up pending completion of a road from the lower tram terminal to the wharf.

Kuskokwim region.—The Kuskokwim region includes the Bethel, Goodnews Bay, McGrath, and Tuluksak-Aniak mining districts, scattered over a large area. Mining activities are handicapped by remoteness from supply and difficulties of transporting materials. There was no production from lode-gold mines in the region. One placer operated in each of the following districts: Goodnews Bay, McGrath, and Tuluksak-Aniak.

The Goodnews Bay Mining Co. operated its floating connected-bucket dredge (equipped with 92 8-cubic foot buckets) and dragline on Salmon River in the Goodnews Bay district from April 28 to November 7. This operation was carried on for the recovery of platinum minerals, but a small quantity of gold was recovered as a byproduct.

In the McGrath district, E. M. Whelan recovered a small amount of gold and silver from the sluicing of bench gravels in the Medfra area.

The New York Alaska Gold Dredging Co., largest gold producer in the region in 1943, operated one of its two bucket dredges on upper Tuluksak River in the Tuluksak-Aniak district and shipped bullion to the Seattle Assay Office.

The development of mercury properties in the Sleitmut-Georgetown area has given an added impetus to mining in the Kuskokwim region. The New Idria-Alaska Quicksilver Mining Co., a subsidiary of the New Idria Quicksilver Mining Co., has taken options on the Red Devil property 8 miles west of Sleitmut and installed a 50-ton Gould rotary furnace, which began operation in October. The Decoursey

Mountain mine, 25 miles northwest of Georgetown, also produced in 1943, using a Gould D-type retort. Several other properties in the area have been examined by the Geological Survey and the Bureau of Mines during the last two years.

Northwestern Alaska region.—Mining in the Northwestern Alaska region in 1943 was confined to a few small hand-operated placers on Dahl and Riley Creeks.

Seward Peninsula region.—Mining operations in the Seward Peninsula region, comprising the Council-Bluff, Fairhaven, Kougarok, Koyuk, Nome, Port Clarence, and Serpentine River districts, were confined to the recovery of placer gold in 1943. Only 4 floating connected-bucket dredges operated in 1943 compared with 14 in 1942. A total of 875,253 cubic yards of gravel containing 10,871 fine ounces of gold and 1,418 fine ounces of silver was handled by the dredges of the region. The average value of the gravel worked, as in 1942, was about 44 cents per cubic yard.

In the Council-Bluff district, the Council Dredging Co. operated its dredge in the Niukluk Valley near Council. It was the only one of seven dredges to operate in the district in 1943. Other placer mining in the district included one hydraulic operation and several small placers operated by hand methods.

The Arctic Circle Exploration Co., largest producer of gold in the Seward Peninsula region in 1943, operated one of its two dredges on Candle Creek in the Fairhaven district. Another bucket dredge (70 buckets of 3-cubic foot capacity) in that district was operated on the Inmachuk River by the Dry Creek Dredging Co. It handled 65,400 cubic yards of gravels and old tailings from June 30 to September 6 and employed seven men, all over draft age. Several hydraulic and smaller placer mines and one drift mine also were in operation in the Fairhaven district in 1943.

No bucket dredges operated in the Kougarok district in 1943. However, numerous placers using dragline, hydraulic, and hand methods worked the gold-bearing gravels in the district; the largest was the operation by Kougarok Consolidated Placers, Inc., on the Kougarok River. Gold is recovered by means of a hydraulic giant, a dragline excavator, and an elevated flume for washing.

The placer production from the Koyuk district in 1943 was recovered from four mines on Dime Creek, all operated by methods other than dredging.

In the Nome district, Lee Bros. Dredging Co. operated one of its two Diesel-powered floating connected-bucket dredges on the Solomon River and handled 300,000 cubic yards of gravel from July 20 to October 28. This was the only dredge in operation in 1943 of the nine dredges in the district. The four dredges in the Snake River area owned by the United States Smelting, Refining & Mining Co. (Nome Department) were idle. Among the larger producers of gold from placers worked by hydraulic giants, with some combination of bulldozers and pumps, were Herbert Engstrom on Clara Creek, B. F. Gillette on Anvil Creek, and E. W. Quigley on Solomon River.

Southeastern Alaska region.—Southeastern Alaska, including the Admiralty Island, Chichagof Island, Hyder, Juneau, Ketchikan, and Windham Bay districts, produced 71 percent of the total lode gold and most of the silver and all the lead output of Alaska in 1943. Only 3 lode mines were active in the region in 1943, compared with 12 in 1942; no placer mines operated.

The Alaska Juneau mine in the Juneau district, though operated at reduced capacity, was the largest producer of gold, silver, and lead in Alaska in 1943. The mine was operated continuously throughout 1943 and part of 1944 but was shut down indefinitely on April 9, 1944. In the Twenty-Ninth Annual Report of the Alaska Juneau Gold Mining Co., for the year ended December 31, 1943, the president's report (dated March 3, 1944) says—

> Those industries which are not maintained wholly or indirectly for the benefit of war efforts have suffered severely by the impact of the conditions and limitations imposed upon them through policy and necessity. Accordingly, the activities of your company during the year under review have suffered curtailment through losses of crew from a normal of about 1,000 men down to about one quarter of that number. This has had a disastrous effect on the financial outcome for the year since the marginal character of operations requires the maximum tonnage output for earning a profit. Throughout the year it has been the policy to conduct operations in the manner that would result in the least financial loss, and in conformance with this policy mining and milling were continued on the best scale possible with the available crew. * * *
>
> The operations for the year resulted in an operating loss, after all charges including depreciation and depletion, of $174,346.06 as a result of mining and milling 1,461,830 tons of ore.
>
> It is quite impossible to forecast the future, since this depends not only on the termination of the war, but also on many factors that will affect Alaska industrial conditions during the early reconstruction period that will follow the war's ending. In any event, operations cannot be resumed until a satisfactory wage scale, based on the price of gold, can be agreed upon.
>
> Inasmuch as all available labor was used in the most essential work, there was a minimum of work done in the mine that was not directly connected with production; accordingly, there is no change in the general appearance of the mine itself. However, in spite of all restrictions, no sacrifices were made to unduly favor production; neither was any effort made during these difficult times to "rob" the mine of its better grade ore, as such an act would unfavorably affect the results of future operations.

The general superintendent's report (dated January 26, 1944) says—

> During the year 1943, the amount of rock trammed from the mine was 1,461,830 tons, as compared to 2,765,190 tons for the previous year and 4,354,770 tons for the year 1941. The North ore body furnished 17 percent of the year's tonnage, the South ore body 13 percent, while the Perseverance section supplied 70 percent of the total.
>
> During the year 117,650 pounds of powder were used in blasting powder drifts, or 0.08 pound per ton trammed. Total powder consumption for primary and secondary breaking was 0.30 pound per ton trammed in 1943, as against 0.28 pound in 1942 and 0.29 pound in 1941. This gives a tonnage ratio of 3.38 tons of ore per pound of powder in 1943, as against 3.55 tons in 1942.
>
> The average daily crew employed on development and preparatory mining for the year was 15.17 as against a normal crew of about 100 men. The present ratio of development and preparatory mining to tonnage output is lower than normal, but is unavoidable under the present operating conditions.
>
> The mine was worked on a two-shift basis during the whole year, while the mill operation was reduced from three shifts to two shifts in March.
>
> *Labor.*—The general shortage of labor increased during the year 1943. The labor turnover, however, was small. The number of employees on the pay roll at the beginning of the year was 478 as against 328 at the end of the year.
>
> The average wage per day in 1943 was $8.58 as against $7.67 in 1942. A large part of this increased wage in 1943 is a result of overtime payments according to Executive Order 9240, which regulates essential industries.
>
> The over-all cost per man per day was $12.47 in 1943 as compared to $11.93 in 1942.

Gold content of ore from Alaska Juneau mine, 1939–43, and total, 1893–1943

Year	Rock to mill from mine (tons)		Gold (ounce)				
			Recovery per ton fine-milled		Losses per ton of tailings		Content of rock from mine to mill
	Ore fine-milled	Coarse tailings rejected	In bullion	In galena concentrates	Fine	Coarse	
1939	2,377,718	2,270,342	0.0454	0.0088	0.0083	0.0066	0.0352
1940	2,308,397	2,431,393	.0442	.0089	.0081	.0065	.0331
1941	2,211,211	2,143,559	.0451	.0092	.0078	.0063	.0347
1942	1,624,601	1,140,589	.0392	.0071	.0079	.0064	.0345
1943	898,384	563,446	.0361	.0083	.0079	.0064	.0346
Total and average, 1893–1943	46,951,229	41,136,049	.0500	.0112	.0117	.0084	.0428

Gold, silver, and lead recoveries from Alaska Juneau mine, 1893–1943

Year	Gold		Silver		Lead		Total value recovered
	Fine ounces	Value	Fine ounces	Value	Pounds	Value	
1893–1913	34,239.49	$707,730.15	(1)	(1)	(1)	(1)	$707,730.15
1914–38	2,352,598.58	59,296,379.82	1,533,861.66	$925,022.57	33,601,862	$1,842,082.52	62,063,484.91
1939	129,011.74	4,515,410.28	111,494.24	75,165.90	2,040,280	104,961.22	4,695,537.40
1940	122,469.96	4,286,448.87	100,633.39	71,154.36	1,666,016	89,568.57	4,447,171.80
1941	120,501.24	4,217,897.67	95,776.56	67,753.89	1,464,956	85,268.93	4,370,920.49
1942	75,537.00	2,643,795.77	62,298.21	44,003.46	938,117	61,318.96	2,749,118.19
1943	40,003.15	1,400,110.13	36,718.23	25,973.79	458,107	29,776.84	1,455,860.76
Total	2,874,361.16	77,067,772.19	1,940,782.29	1,209,073.97	40,169,338	2,212,977.04	80,489,823.20

[1] Lost in tailings.

Summary of production and operating costs, Alaska Juneau mine, 1914–43, inclusive

	1,461,830 tons		2,765,190 tons		87,580,024 tons	
	1943	Per ton trammed	1942	Per ton trammed	1914–43	Per ton trammed
Production (gross recovered gold, silver, and lead values):						
Bullion	$1,140,625.95	$0.780	$2,242,104.03	$0.811	$63,477,886.34	$0.725
Concentrates	315,234.81	.216	507,014.16	.183	16,304,206.71	.186
	1,455,860.76	.996	2,749,118.19	.994	79,782,093.05	.911
Costs:						
Mining	726,577.98	.497	1,095,681.58	.396	26,996,031.45	.308
Milling	575,638.09	.394	791,041.94	.286	21,547,693.56	.245
Other Juneau operating and marketing costs	115,604.04	.079	167,492.84	.061	4,285,642.05	.049
General corporation and pay-roll taxes	79,620.56	.054	139,947.19	.051	1,947,166.76	.022
Total Juneau operating and marketing costs	1,497,440.67	1.024	2,194,163.55	.794	54,776,533.82	.624
All other costs	49,762.86	.034	56,392.04	.020	3,644,810.52	.042
Total operating costs and expenses	1,547,203.53	1.058	2,250,555.59	.814	58,421,344.34	.666
Juneau operating profit	[1] 41,579.91	[1] .028	554,954.64	.200	25,006,559.23	.287
Net operating profit	[1] 91,342.77	[1] .062	498,562.60	.180	21,360,748.71	.245
Other revenue (interest, etc.)	89,545.91	....	75,738.81	....	884,937.10	....
Profit before depreciation, depletion, and income taxes	[1] 1,796.86	....	574,301.41	....	22,245,685.81	....

[1] Deficit.

There were also shipments from two other mines in the Juneau district in 1943, both of which were clean-ups. The LeRoy Mining Co. on the LeRoy claim near Lamplugh Glacier shipped gold concentrates recovered from milling operations conducted in 1942. The company did not operate the mine or mill in 1943. Howard C. Hayes reworked old tailings from the Thane mill and shipped gold concentrates to the Tacoma (Wash.) smelter.

The Hirst-Chichagof Mining Co. resumed operations at its mine near the head of Kimshan Cove on Chichagof Island in February 1943 by permission of the War Production Board but was forced to close again in August owing to the difficulties encountered in obtaining labor, supplies, and equipment. The company was the second-largest producer of gold in the region. The bullion product from the operation of the company 35-ton amalgamation-flotation mill was sent direct to the Seattle Assay Office and the concentrates were shipped to the Tacoma (Wash.) smelter.

The Salt Chuck mine of the Alaska Gold & Metals Co. on Prince of Wales Island was the largest producer of copper in Alaska in 1943. Copper concentrates containing gold, silver, and copper were shipped to the Tacoma (Wash.) smelter. The ore from this mine contains palladium in addition to gold, silver, and copper.

There was no production of gold, silver, or base metals in the Admiralty Island, Hyder, or Windham Bay districts in 1943. The Riverside tungsten mine in the Hyder district, owned and operated by the J. H. Scott Co., was worked on an increased scale in 1943. The mine ore was treated in the company mill.

Yukon River Basin region.—The Yukon River Basin region embraces all the territory in the Yukon River Valley in Alaska. It is divided into 20 mining districts, as follows: Bonnifield-Nenana, Chandalar, Chisana, Circle, Delta River, Eagle, Fairbanks, Fortymile, Goodpaster, Hot Springs, Hughes, Iditarod, Innoko, Kantishna, Koyukuk, Marshall, Rampart, Ruby, Tolovana, and Yukon Flats. The region was the second-largest producer of gold and silver in the Territory and produced 23 percent of the total gold in 1943.

Only two floating connected-bucket dredges operated in the region in 1943 compared with 15 in 1942. Alluvial Golds, Inc., operated its W. W. Johnson Co. dredge (with 72 4-cubic foot buckets) on Woodchopper Creek in the Circle district and handled about 199,500 cubic yards of gravel. The dredge was operated chiefly to give employment to the older men in the area who are beyond military age. The Ganes Mining Co. operated its dredge (64 3½-cubic foot buckets) on Ganes Creek in the Innoko district from July 9 to October 9, 1943. The company obtained permission from the War Production Board to resume operations in 1943, provided only men over the draft age and not otherwise qualified for any type of war work were employed.

The Alaska gold properties of the United States Smelting, Refining & Mining Co., including eight floating connected-bucket dredges in the Fairbanks district, were closed throughout 1943 following the Gold Mining Limitation Order in the fall of 1942. The company still keeps 15 to 20 men over 55 years of age employed to care for the dredges and thawing equipment and to maintain a small flow of water to prevent damage. Some of the buildings have been leased to the Northwest Service Command, and the revenues are used to defray some of the shut-down expenses. The dredges are being maintained in good condition, and a large yardage of proved ground is available when operations can be resumed.

In addition to the two dredges, about 21 hydraulic operations and 33 placer operations of all other types were active in 1943 throughout the Yukon River Basin region.

In the Bonnifield-Nenana district only a few small placer camps, using hand methods alone, operated in 1943.

Placer mining in the Chisana district was limited to the operations of five prospectors using simple hand methods.

In the Circle district two hydraulic mines were in operation in addition to the Alluvial Golds, Inc., dredge. The largest producer was John A. Anderson, who washed about 8,000 yards of gold-bearing gravel on Mastodon Creek with three 2-inch hydraulic giants.

There were only three small producers, including one hydraulic operation, in the Eagle district in 1943.

Placer mining in the Fairbanks district was limited to the operations of one hydraulic mine worked by Fred C. Bleecher on First Chance Creek and two small hand placers on Fox and Yankee Creeks.

Larger placer operators in the Fortymile district were Koland & Kirkpatrick, operating a hydraulic giant and bulldozer on the Lost Chicken Hill mines on Fortymile River, and Aaron Johnson, operating one hydraulic giant on Chicken Creek, a tributary of Fortymile River.

In the Hot Springs district the most productive placer mining was done by J. R. Frank & Co., which operated two hydraulic giants at its claim on the right limit of Pioneer Creek from May 20 to September 18, and Johnson & Johnson Co., hydraulicking on Glenn Gulch, both in the Eureka area.

In the Iditarod district the Awe Mining Co., Peter Miscovich & Sons, Uotila & Ogriz, Backstrom & Olson, Fred Lusher, and Frank Salen all operated during the 1943 season, using bulldozers and hydraulic giants. The district showed the largest production of gold from placer mining other than dredging in the Yukon River Basin region in 1943.

Degnan & Rosander operated its hydraulic-bulldozer equipment on Little Creek, a tributary of Innoko River 5 miles above Ophir, and handled old dredge tailings and stream gravel. Moreover, several small placer miners using hand methods worked in the district.

The only producer of gold in the Kantishna district in 1943 was Dewey Burnett, operating a small placer on Crooked Creek, a tributary to Toklat River.

In the Koyukuk district about 8 camps recovered placer gold in 1943. In addition to one hydraulic mine operating on Thompson's Pup, a tributary of Fay Creek, there were small mines using hand methods on Nolan, Archibald, and Porcupine Creeks and on Hammond River. Most of the mines were developed by surface methods, but at a few places deep ground was drifted.

A small amount of gold was recovered from ground sluicing of stream gravels on Little Minook Creek, 7 miles southeast of Rampart in the Rampart district, by the Little Minook Mining Co. One other productive camp in this district in 1943 was the Ben Dahl mine on Hunter Creek operated by Ben Dahl.

Other large producers among these types of placer operations in the Yukon River Basin region in 1943 were the Long Creek Mining Co. on Long Creek in the Ruby district and the Amy Creek Mining Co., John Jurich, and John Radak in the Tolovana district.

Lode mining in the Yukon River Basin region produced only 3,561 fine ounces of gold and 862 fine ounces of silver in 1943 compared with 14,478 ounces of gold and 3,441 ounces of silver in 1942.

The only producer of lode gold in the region in 1943 was the Cleary Hill mine and amalgamation-flotation mill in the Fairbanks district 27 miles northeast of Fairbanks. Bullion was shipped to the Seattle Assay Office and gold-silver concentrate containing a small amount of lead to the smelter at Tacoma, Wash. This company is also developing two tungsten mines in this district in the vicinity of Gilmore Dome at the head of Gilmore Creek.

In the Kantishna district Earl Pilgrim operated the Stampede antimony mine during 1943 and produced high-grade antimony ore and concentrates.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA

(MINE REPORT)

By G. E. Woodward and Paul Luff

SUMMARY OUTLINE

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SUMMARY

The total value of the output of recoverable metals from Arizona mines was $121,212,902 in 1943 compared with $114,525,600 in 1942—a 6-percent increase (see fig. 1); it was the greatest value since 1929, when the total was $155,567,133. Both the quantity and value of copper and zinc increased substantially in 1943; the quantity of lead decreased, but its value increased owing to the higher average price of the metal; and both the quantity and value of gold and silver were much less than in 1942. The total value of the copper was $104,827,060—a 10-percent gain over 1942; lead, $2,059,050—a 4-percent gain; and zinc, $4,250,232—a 23-percent gain. The value of the gold was $6,013,350—a 32-percent loss; and silver, $4,063,210—a 19-percent loss. The gold production represented 5 percent of the State total value, silver 3 percent, copper 86 percent, lead 2 percent, and zinc nearly 4 percent. The value of the metals recovered from copper ore and its products was $112,020,217 in 1943, or 92 percent of the State total. The output of copper was greater in 1943 than in any year except 1929, when it was 830,628,411 pounds; and the output of zinc exceeded the record output of 1942.

Production of copper, lead, zinc, and silver in Arizona in 1943 was affected by several factors: A serious shortage of labor, which persisted throughout the year; the construction (by the Defense Plant Corporation) of an additional concentrator of 15,000 tons daily capacity at the Morenci property of the Phelps Dodge Corporation; the completion in May of a 10,000-ton flotation plant at the Castle Dome Copper property near Miami; the milling of copper ore, beginning in March, in the new 2,500-ton concentrator at the Bagdad property near Hillside; the milling of zinc-lead ore, beginning in September, from the San Xavier mine near Tucson by the Eagle-Picher Mining & Smelting Co.; the shipping of zinc-lead ore, beginning in November, from the Copper Queen mine at Bisbee; the decrease in output of zinc-lead ore and the lower grade of ore at the Trench-Flux group; and the marked decline in output of copper from the Ray and United Verde properties.

The Government gold-mine closing order issued in October 1942 resulted in an unusually large decrease in output of siliceous ores in 1943, especially gold ore, as nearly all large producers of gold ore were idle throughout the year.

The basic Government policy of premium payments for overquota production was in force throughout 1943; however, the War Production Board announced November 9 that no applications would be considered after December 31, 1943, for the special copper premium price; that effective October 27 premium prices in the B range would be denied to lead mines not already operating and to lead mines having a low labor productivity and in areas of serious labor shortage; that premium prices in the B and C ranges would be denied to zinc mines not already operating and to zinc mines having a low labor productivity and in areas of serious labor shortage; and that the Government is not now financing new zinc projects. The War Production Board stated that the curtailment in the copper premium price was necessary owing to the success of efforts toward balancing the copper supply with the requirements of the armed services and the most essential civilian uses. Restrictions were placed on lead and zinc premium prices because of increased mineral production, revised military requirements, and a greater need of manpower in the larger producing mines.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1939–43, and total, 1860–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	976	142	18,793,260	316,453	$11,075,855	7,824,004	$5,310,839
1940	1,024	276	21,572,175	294,807	10,318,245	7,075,215	5,031,264
1941	805	184	25,491,794	315,392	11,038,720	7,498,260	5,332,096
1942	515	163	33,920,731	253,651	8,877,785	7,064,467	5,023,621
1943	274	19	36,630,788	171,810	6,013,350	5,713,889	4,063,210
1860–1943			(1)	10,599,750	258,466,405	281,466,394	208,968,600

[1] Figures not available.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1939–43, and total, 1860–1943, in terms of recovered metals—Continued

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	524,224,000	$54,519,296	21,542,000	$1,012,474	13,422,000	$697,944	$72,616,408
1940	562,338,000	63,544,194	26,532,000	1,326,600	30,912,000	1,947,456	82,167,759
1941	652,634,000	77,010,812	31,276,000	1,782,732	32,986,000	2,473,950	97,638,310
1942	786,774,000	95,199,654	29,544,000	1,979,448	37,044,000	3,445,092	114,525,600
1943	806,362,000	104,827,060	27,454,000	2,059,050	39,354,000	4,250,232	121,212,902
1860–1943	[2] 10,243,363	3,041,281,930	[2] 310,553	36,538,148	[2] 164,502	26,838,125	3,572,113,208

[2] Short tons.

Gold and silver produced at placer mines in Arizona, 1939–43, in fine ounces, in terms of recovered metals

Year	Sluicing [1]		Drift mining		Dredges				Total	
					Dry-land [2]		Dragline floating [2]			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1939	1,919	227	1,850	125	(3)	(3)	[3] 2,640	[3] 339	6,409	691
1940	1,625	207	646	41	1,186	464	2,784	396	6,241	1,108
1941	976	125	77	5	824	717	10,054	1,358	11,931	2,205
1942	885	176	....	....	35	5	1,916	217	2,836	398
1943	315	14	4	....	....	....	....	....	319	14

[1] Includes placer sands treated by dry concentration plants.

[2] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

[3] Figures for dragline floating dredges include those for dry-land dredges.

Gold.—The output of recoverable gold in Arizona in 1943 was 171,810 fine ounces—a 32-percent decrease from 1942. Gold from siliceous ores (chiefly dry and siliceous gold ore) declined 68,426 ounces, or more than 72 percent, and that from copper ore nearly 8 percent; gold from zinc-lead ore increased nearly 16 percent. The gold output decreased sharply in the strictly gold-producing districts, such as the San Francisco (Oatman, Goldroad, Katherine), Weaver (Octave), Martinez (Congress), and Vulture. Gold from placers declined from 2,836 to 319 ounces, as no dredges of any type operated in Arizona in 1943. The Copper Queen (Bisbee) branch of the Phelps Dodge Corporation continued to be the leading gold producer in Arizona; it was followed by the New Cornelia mine in Pima County, the United Verde mine in Yavapai County, the Mammoth-St. Anthony Limited property and the Magma mine (both in Pinal County), and the Iron King mine in Yavapai County; these six properties produced 85 percent of the State total gold. Copper ore yielded 78 percent of the State total gold, siliceous ores 15 percent, and zinc-lead ore nearly 6 percent. The chief gold-producing districts in Arizona were the Warren, Ajo, Verde, Old Hat, Pioneer (Superior), and Big Bug.

Silver.—The output of recoverable silver in Arizona in 1943 was 5,713,889 fine ounces—a 19-percent decrease from 1942. The chief decreases were 626,548 ounces in silver from copper ore, 539,097 ounces from siliceous ores, 117,594 ounces from zinc-lead ore and zinc-lead-copper ore, 41,501 ounces from zinc ore and zinc-copper ore, and 25,450 ounces from lead ore. Copper ore yielded 76 percent of the State total silver, zinc-lead ore 11 percent, siliceous ores 7 percent, zinc-copper ore 3 percent, zinc-lead-copper ore 1 percent, and lead ore 1 percent. The Phelps Dodge Corporation continued to be the chief silver producer in Arizona, although its output was 12 percent less than in 1942 (decrease mainly at United Verde mine); its four properties (Copper Queen, Morenci, New Cornelia, and United Verde) produced 69 percent of the State gold output, 66 percent of the silver, and 58 percent of the copper. Other large silver producers in Arizona in 1943 were the Magma, Iron King, Trench-Flux, Ash Peak, and Shattuck Denn properties. The chief silver-producing districts were the Warren (Bisbee), Verde (Jerome) Ajo, Pioneer (Superior), Big Bug, Harshaw, and Copper Mountain (Morenci); more than 57 percent of the State total silver came from the Warren and Verde districts.

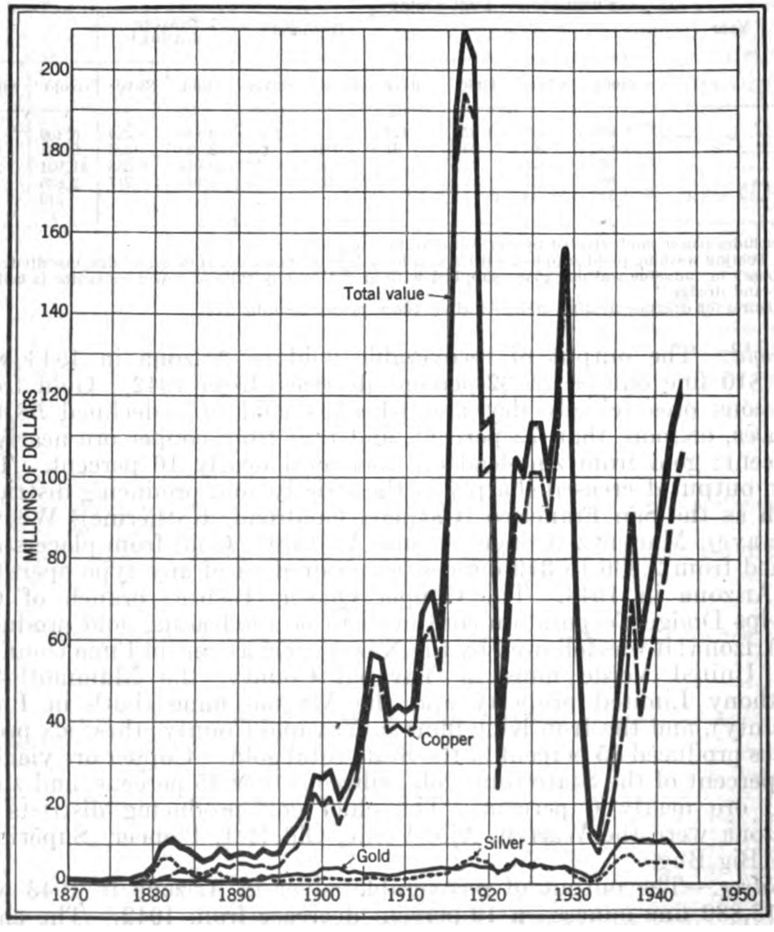

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870-1943. The value of lead and zinc has been less than $2,000,000 annually, except in a few years.

Copper.—Arizona has been the outstanding producer of copper in the United States since 1907 except in 1909, when Montana held first place. The output of recoverable copper in Arizona in 1943 was 806,362,000 pounds—an increase of more than 2 percent over 1942 and larger than in any year except 1929, when it was 830,628,411 pounds. The Globe-Miami district, with a production of 201,026,600 net pounds of copper, continued to be the leading copper area in the State; it was followed by the Copper Mountain (Morenci) district with 168,694,400 pounds, Ajo with 140,138,000 pounds, Warren (Bisbee) with 101,572,900 pounds, Mineral Creek (Ray) with 74,868,400 pounds, Verde (Jerome) with 68,467,100 pounds, and Pioneer (Superior) with 37,640,000 pounds. Marked increases in copper output were made in the Copper Mountain, Globe-Miami, and Ajo districts, but substantial decreases were recorded in the Mineral Creek, Verde, Warren, and Pioneer districts; these seven districts contributed 98 percent of the State total copper. Copper ore and its products yielded 801,786,501 pounds of copper, as follows: 30,595,456 tons of copper ore treated by concentration yielded 68 percent; 1,704,698 tons of copper ore shipped crude to smelters, 17 percent; and 3,721,926 tons of copper ore leached and 25,260 tons of cement copper (from mine-water precipitates and underground leaching operations); 15 percent. The Morenci branch of the Phelps Dodge Corporation was the largest copper producer in Arizona in 1943; it was followed in order by the New Cornelia branch of the Phelps Dodge Corporation, Inspiration, Copper Queen, Ray (Nevada Consolidated Copper Corporation), Miami, United Verde, Magma, and Castle Dome properties.

Lead and zinc.—The output of recoverable lead in Arizona in 1943 was 27,454,000 pounds—a 7-percent decrease from 1942. The output of recoverable zinc was 39,354,000 pounds—the largest in any year in the history of the State and 6 percent more than the record output of 1942. The marked decrease in lead output from the Trench-Flux group caused a decline in the State lead output, and the production of zinc from the San Xavier and Copper Queen mines during the last quarter of the year prevented a decline in the State zinc output. About 30 percent of the State total lead and 27 percent of the zinc came from mines near Patagonia in Santa Cruz County, 24 percent of the lead and 33 percent of the zinc from Pinal County, nearly 10 percent of the lead and 16 percent of the zinc from Yavapai County, and 10 percent of the lead and 8 percent of the zinc from Mohave County; most of the remaining lead and zinc output came from Cochise and Pima Counties. About 74 percent of the total lead and nearly 68 percent of the total zinc came from zinc-lead ore; nearly all the rest of the lead came from lead ore, siliceous ores, zinc-lead-copper ore, zinc-copper ore, and zinc ore; and all the rest of the zinc came from zinc-copper ore, zinc-lead-copper ore, and zinc ore. The Trench-Flux group of the American Smelting & Refining Co. near Patagonia in Santa Cruz County continued to be the leading producer of lead in the State; it was followed in order by the Mammoth-St. Anthony Limited property at Tiger, Tennessee mine at Chloride, Iron King mine at Humboldt, Arizona Lead Co. property near Yuma, Copper Queen mine at Bisbee, and San Xavier mine near Tucson. The principal producer of zinc in the State in 1943 was the Magma mine at Superior; it was followed in order by the Trench-Flux, Iron King, Mammoth-St. Anthony Limited, Tennessee, Duquesne, San Xavier, and Copper Queen properties.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Cochise	22	1	57, 217	$2, 002, 595	2, 278, 672	$1, 620, 389
Coconino	5		13	455	3, 849	2, 737
Gila	23		2, 468	86, 380	122, 203	86, 900
Graham	4		57	1, 995	1, 613	1, 147
Greenlee	7		4, 677	163, 695	331, 920	236, 032
Maricopa	14		1, 219	42, 665	13, 365	9, 504
Mohave	28	1	5, 201	182, 035	99, 571	70, 806
Pima	31	2	45, 338	1, 586, 830	563, 234	400, 522
Pinal	25		26, 026	910, 910	593, 820	422, 272
Santa Cruz	18		217	7, 595	316, 731	225, 231
Yavapai	73	13	28, 733	1, 005, 655	1, 321, 394	939, 658
Yuma	24	2	644	22, 540	67, 517	48, 012
	274	19	171, 810	6, 013, 350	5, 713, 889	4, 063, 210
Total, 1942	515	163	253, 651	8, 877, 785	7, 064, 467	5, 023, 621

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	101, 631, 000	$13, 212, 030	2, 127, 200	$159, 540	2, 337, 000	$252, 396	$17, 246, 950
Coconino	507, 000	65, 910	175, 600	13, 170			82, 272
Gila	202, 197, 000	26, 285, 610	832, 800	62, 460	814, 000	87, 912	26, 609, 262
Graham	68, 000	8, 840	79, 400	5, 955	65, 000	7, 020	24, 957
Greenlee	168, 695, 000	21, 930, 350	1, 400	105			22, 330, 182
Maricopa	540, 000	70, 200	701, 600	52, 620			174, 989
Mohave	360, 000	46, 800	2, 790, 000	209, 250	3, 084, 000	333, 072	841, 963
Pima	141, 429, 000	18, 385, 770	1, 339, 000	100, 425	2, 906, 000	313, 848	20, 787, 395
Pinal	113, 051, 000	14, 696, 630	6, 691, 000	501, 825	13, 044, 000	1, 408, 752	17, 940, 389
Santa Cruz	1, 004, 000	130, 520	8, 243, 000	618, 225	10, 657, 000	1, 150, 956	2, 132, 527
Yavapai	76, 772, 000	9, 980, 360	2, 627, 000	197, 025	6, 447, 000	696, 276	12, 918, 974
Yuma	108, 000	14, 040	1, 846, 000	138, 450			223, 042
	806, 362, 000	104, 827, 060	27, 454, 000	2, 059, 050	39, 354, 000	4, 250, 232	121, 212, 902
Total, 1942	786, 774, 000	95, 199, 654	29, 544, 000	1, 979, 448	37, 044, 000	3, 445, 092	114, 525, 600

Gold and silver produced at lode mines in Arizona in 1943, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Cochise	1, 297, 798	57, 216	2, 278, 672
Coconino	5, 261	13	3, 849
Gila	12, 228, 147	2, 468	122, 203
Graham	1, 515	57	1, 613
Greenlee	9, 677, 835	4, 677	331, 920
Maricopa	27, 987	1, 219	13, 365
Mohave	69, 136	5, 199	99, 571
Pima	8, 992, 590	45, 334	563, 234
Pinal	2, 905, 146	26, 026	593, 820
Santa Cruz	95, 101	217	316, 731
Yavapai	1, 386, 733	28, 431	1, 321, 380
Yuma	33, 539	634	67, 517
	36, 630, 788	171, 491	5, 713, 875
Total, 1942	33, 920, 731	250, 815	7, 064, 069

Gold and silver produced at placer mines in Arizona in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing [1]		Drift mining		Dredges				Total	
					Dry-land [2]		Dragline floating [2]			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Cochise	1								1	
Mohave	2								2	
Pima	4								4	
Yavapai	302	14							302	14
Yuma	6		4						10	
	315	14	4						319	14
Total, 1942	885	176			35	5	1,916	217	2,836	398

[1] Includes placer sands treated by dry concentration plants.

[2] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

MINING INDUSTRY

In spite of a serious labor shortage throughout 1943 in the large copper-producing and zinc-lead districts of Arizona, more ore was mined than in any year in the history of the State. The total (36,630,788 tons) exceeded the record production of 1942 by 2,710,057 tons. The output of copper ore was 36,022,080 tons—the largest ever made and a 10-percent gain over 1942; zinc-lead ore and zinc-lead-copper ore, 289,369 tons—a 9-percent gain; lead ore, 41,006 tons—a 58-percent gain; and zinc ore and zinc-copper ore, 91,966 tons—a 19-percent loss. The output of siliceous ores (chiefly gold ore) was 186,185 tons compared with 657,942 tons in 1942—a 72-percent decline, resulting from the closing in 1942 of nearly all the gold mines. Of the total ore, 35,561,059 tons (97 percent) was copper ore mined in the Globe-Miami, Copper Mountain (Morenci), Ajo, Mineral Creek (Ray), Warren (Bisbee), Verde (Jerome), and Pioneer (Superior) districts; 95 percent of the total zinc-lead ore was mined in the Big Bug, Harshaw, Old Hat (Oracle), Wallapai (Chloride), Pima, and Warren (Bisbee) districts; all the zinc-lead-copper ore came from one property in the Patagonia district; nearly all the zinc-copper ore from one mine in the Pioneer (Superior) district; and 66 percent of the lead ore from one property in the Castle Dome district. Nearly 88 percent of the State total gold ore came from three properties in the Old Hat (Oracle), San Francisco, and Vulture districts; 90 percent of the gold-silver ore from two mines in the Verde (Jerome) district; and 75 percent of the silver ore from one mine in the Ash Peak district. Mining operations at two open pits—Ajo and Morenci—produced a total of 18,609,014 tons of copper ore.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Arizona in 1943, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	56	138,144	23,019	48,540	158,370	1,311,027	----------
Dry and siliceous gold-silver ore	12	23,662	2,097	91,154	491,545	15,255	----------
Dry and siliceous silver ore	16	24,379	768	246,515	19,710	4,292	----------
	84	186,185	25,884	386,209	669,625	1,330,574	----------
Copper ore	118	36,022,080	133,746	4,367,003	[1] 801,786,501	19,179	----------
Lead ore	67	41,006	1,131	76,019	60,203	4,621,086	----------
Lead-copper ore	2	182	1	2,393	9,085	26,415	----------
Zinc ore	5	3,083	11	11,588	36,879	70,734	697,166
Zinc-copper ore	3	88,883	1,004	152,242	2,049,366	303,800	9,259,812
Zinc-lead ore	33	262,630	9,699	640,558	1,183,021	20,277,112	26,635,922
Zinc-lead-copper ore	1	26,739	15	77,863	567,320	805,100	2,761,100
Total, lode mines	[2] 274	36,630,788	171,491	5,713,875	[1] 806,362,000	27,454,000	39,354,000
Total, placers	19	----------	319	14	----------	----------	----------
	293	36,630,788	171,810	5,713,889	[1] 806,362,000	27,454,000	39.354,000
Total, 1942	678	33,920,731	253,651	7,064,467	[3] 786,774,000	29,544,000	37,044,000

[1] Includes 117,416,341 pounds recovered from ore leached and mine-water precipitates.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[3] Includes 129,292,755 pounds recovered from ore leached and mine-water precipitates.

METALLURGIC INDUSTRY

Of the 36,630,788 tons of ore produced in 1943 in Arizona, 30,986,501 tons (nearly 85 percent) were treated at concentration plants; 3,721,926 tons (10 percent) at a leaching plant; 144,342 tons (less than 1 percent) at amalgamation, cyanidation, and cyanidation-concentration mills; and 1,778,019 tons (5 percent) were shipped crude to smelters.

Gold ore treated at amalgamation mills decreased from 765 tons in 1942 to 4 tons in 1943 and siliceous material treated at cyanidation and cyanidation-concentration plants from 542,916 to 144,338 tons; 4 straight cyanidation plants treated 24,700 tons of material in 1943 compared with 15 plants that treated 337,350 tons in 1942. The most important plants were those at the Mammoth-St. Anthony Limited, Iron King, and Gold Standard properties; only one plant remained in operation at the close of the year. Three companies reported cyaniding 110,971 tons of siliceous material and using 6,833 pounds of sodium cyanide, 243,100 pounds of Aero Brand calcium cyanide, 5,930 pounds of zinc dust, 284,740 pounds of lime, and 11,000 pounds of copperas.

Ore treated at concentration plants in 1943 comprised chiefly 30,595,456 tons of copper ore, 226,886 tons of zinc-lead ore, 88,883 tons of zinc-copper ore, 29,006 tons of lead ore, and 26,739 tons of zinc-lead-copper ore. Copper ore from the Miami property was treated by a combination of leaching and concentration, and copper ore from the Inspiration mine was treated by straight leaching and by leaching and concentration. The large copper-concentration plants at Ajo, Clarkdale, Hayden, Miami, Morenci, and Superior were operated at capacity in 1943, as well as the copper-leaching plants at

Inspiration and Miami and the copper smelters at Clarkdale, Douglas, Hayden, Miami, Morenci, and Superior. The rated capacity of charge of the six copper smelters was as follows: Clarkdale, 1,400,000 tons per year; Douglas, 1,600,000; Hayden, 360,000; Miami, 360,000; Morenci, 450,000; and Superior (Magma), 210,000. The Phelps Dodge Corporation reported that the Douglas smelter operated throughout the year on a three-furnace basis and smelted a total of 1,162,830 tons of new material. This plant has been operating continuously at maximum capacity for a longer than normal period; as a result, heavy repairs became necessary at the end of the year. At the Clarkdale smelter, two reverberatory furnaces operated continuously, but the average smelting rate was lower than in 1942; 875,953 tons of new material were treated in 1943. The Morenci smelter treated a total of 443,373 tons of new material; construction work on the extension to the smelter was carried on throughout the year. The 20-ton smelter at Tiger is the only lead smelter in Arizona; it operated exclusively on concentrates from the mill of Mammoth-St. Anthony, Limited.

The following tables give details of the treatment of all ores produced in Arizona in 1943.

Mine production of metals in Arizona in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	4	21	3			
Ore, old tailings, and current tailings cyanided	144,338	4,755	25,782			
Concentrates smelted	1,420,677	89,015	2,501,717	553,232,888	24,658,846	39,242,425
Ore smelted	1,778,019	77,700	3,186,373	135,712,771	2,795,154	111,575
Copper precipitates smelted	25,260			[1] 37,361,514		
Copper ore leached	[2] 3,721,926			80,054,827		
Placer		319	14			
		171,810	5,713,889	806,362,000	27,454,000	39,354,000
Total, 1942		253,651	7,064,467	786,774,000	29,544,000	37,044,000

[1] Distributed as follows: Cochise County, 990,877 pounds; Gila County, 13,643,117 pounds; Greenlee County, 9,885,950 pounds; Pinal County, 12,300,000 pounds; and Yavapai County, 541,570 pounds.

[2] Treated by straight leaching at 1 plant in Gila County.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Arizona in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Pima	3	1		1	3	44		200	
Yuma	1	20	3						
	4	21	3	1	3	44		200	
Total, 1942	765	827	146	5	17	40		610	
CYANIDATION MILLS									
Mohave	20,960	2,789	7,992						
Pinal	84,236	1,404	4,200	2,112	13,879	11,661	8,700	1,296,000	
Yavapai	35,652	361	13,396	7,888	2,650	98,037	65,874	1,065,960	2,850,000
Yuma	3,500	201	194						
	144,338	4,755	25,782	10,000	16,529	109,698	74,574	2,361,960	2,850,000
Total, 1942	542,916	45,713	103,800	4,113	28,888	28,871	24,361	2,234,200	
Grand total: 1943		4,776	25,785	10,001	16,532	109,742	74,574	2,362,160	2,850,000
1942		46,040	103,946	4,118	28,905	28,911	24,361	2,234,810	

Mine production of metals from concentrating mills in Arizona in 1943, by counties, in terms of recovered metals

County	Material treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	12,583	3,836	182	29,825	143,948	1,422,149	2,337,000
Gila	8,449,149	187,402	2,358	114,289	105,423,128	657,200	814,000
Graham	357	123	4	565	6,314	57,500	65,000
Greenlee	9,577,595	373,183	3,585	186,300	155,555,100		
Maricopa	17,167	493	615	1,444	2,886	70,811	
Mohave	42,408	6,928	1,622	84,711	69,107	2,727,750	3,084,000
Pima	8,985,882	264,867	45,171	543,644	140,965,362	1,193,557	2,831,000
Pinal	2,745,573	255,562	8,612	461,780	90,533,780	5,231,164	13,044,000
Santa Cruz	91,901	18,100	99	288,273	974,120	7,789,800	10,657,000
Yavapai	1,036,895	298,404	10,223	661,684	59,483,029	1,368,198	3,560,425
Yuma	26,991	1,778	12	19,460	1,540	1,778,557	
	30,986,501	1,410,676	72,483	2,391,975	553,158,314	22,296,686	36,392,425
Total, 1942	27,102,358	1,318,699	76,173	2,639,405	495,566,100	23,525,300	36,734,500

Gross metal content of concentrates produced from ores mined in Arizona in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	256	513	492	1,221	2,181	------
Copper	1,346,056	67,140	1,835,554	567,879,827	51,915	15,565,970
Lead	22,176	17,720	487.798	622,787	21,480,981	2,972,390
Lead-copper	2,578	680	148,686	421,976	2,555,070	471,595
Zinc	36,723	1,671	177,033	686,425	1,790,839	38,367,672
Zinc-copper	15	------	97	6,458	------	16,755
Zinc-lead	6,682	426	18,478	266,286	1,436,127	5,682,126
Iron	6.191	3.808	16.898	17,666	173,090	492,342
	1,420,677	91 958	2,685,036	569,902,646	27,490,203	63.568,850
Total, 1942	1,322,817	105,078	2,668,316	510,243,062	29,142,557	48,334.065

Mine production of metals from Arizona concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	3,836	182	29,825	143,948	1,422,149	2,337.000
Gila	187,402	2,358	114,289	105,423,128	657,200	814,000
Graham	123	4	565	6,314	57,500	65,000
Greenlee	373,183	3,585	186,300	155,555,100	------	------
Maricopa	493	615	1,444	2,886	70,811	------
Mohave	6,928	1,622	84,711	69,107	2,727,750	3,084,000
Pima	264,868	45,174	543,688	140.965,362	1,193,757	2.831,000
Pinal	257,674	22,491	473,441	90,542,480	6,527,164	13,044,000
Santa Cruz	18,100	99	288,273	974,120	7,789,800	10,657,000
Yavapai	306,292	12,873	759,721	59,548.903	2.434,158	6,410,425
Yuma	1,778	12	19,460	1,540	1,778,557	------
	1,420,677	89,015	2,501,717	553,232,888	24,658,846	39,242,425
Total, 1942	1,322,817	105,078	2,668,316	495,590,461	25,760,110	36,734,500

BY CLASSES OF CONCENTRATES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	256	513	492	1,106	1,370	------
Copper	1,346,056	64,874	1,717.704	551,605,018	36,400	------
Lead	22,176	17,720	487,798	498,708	19,992.555	------
Lead-copper	2,578	680	148,686	344,222	2,349,467	------
Zinc	36,728	1,113	117,067	549.269	1,163,329	34,167,510
Zinc-copper	15	------	65	5,166	------	14,912
Zinc-lead	6,682	307	13,007	215.521	958,243	5,060,003
Iron	6,191	3,808	16,898	13,878	157,482	------
	1,420,677	89,015	2,501,717	553,232,888	24,658,846	39,242,425

Gross metal content of Arizona crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	13,197	4,211	24,660	156,345	17,256	
Dry and siliceous gold-silver	23,634	2,093	91,054	520,200	165,441	
Dry and siliceous silver	24,109	766	245,432	20,518	5,455	
Copper	1,704,698	69,854	2,771,240	145,628,793	44,665	
Lead	12,000	937	53,820	69,622	2,973,176	
Lead-copper	182	1	2,393	10,951	29,040	
Zinc	107			1,243	2,743	93,224
Zinc-lead	92	1	700	4,148	6,904	55,962
	1,778,019	77,863	3,189,299	146,411,820	3,244,680	149,186
Total, 1942	2,075,424	99,697	4,291,807	174,164,610	4,365,497	383,485

Mine production of metals from Arizona crude ore shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	1,195,215	57,034	2,248,847	100,496,175	705,051	
Coconino	5,261	13	3,849	507,000	175,600	
Gila	57,072	110	7,914	3,075,928	175,600	
Graham	1,158	53	1,048	61,686	21,900	
Greenlee	100,240	1,092	145,620	3,253,950	1,400	
Maricopa	10,820	604	11,921	537,114	630,789	
Mohave	5,778	788	6,868	290,893	62,250	
Pima	6,705	159	19,546	463,638	145,243	75,000
Pinal	75,337	2,131	116,179	10,208,520	163,836	
Santa Cruz	3,200	118	28,458	29,880	453,200	
Yavapai	314,186	15,197	548,263	16,681,527	192,842	36,575
Yuma	3,047	401	47,860	106,460	67,443	
	1,778,019	77,700	3,186,373	135,712,771	2,795,154	111,575
Total, 1942	2,075,424	99,697	4,291,807	161,890,784	3,783,890	309,500

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	13,197	4,211	24,660	148,564	13,457	
Dry and siliceous gold-silver	23,634	2,093	91,054	491,545	13,755	
Dry and siliceous silver	24,109	766	245,432	19,710	3,695	
Copper	1,704,698	69,691	2,768,314	134,983,492	19,179	
Lead	12,000	937	53,820	55,903	2,710,453	
Lead-copper	182	1	2,393	9,085	26,415	
Zinc	107			946	1,400	75,000
Zinc-lead	92	1	700	3,526	6,800	36,575
	1,778,019	77,700	3,186,373	135,712,771	2,795,154	111,575

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Cochise County:													
California	2		111	3		3	585		585	13,000	400		$2,241
Cochise	1		193				59		59	8,700			1,173
Dos Cabezas and Tevis	2		84	14		14	249		249	6,300			1,486
Golden Rule (Dragoon)	2		411	1		1	412		412	3,000	12,200	122,000	14,809
Hartford (Huachuca Mountains)	2	1	923	20	1	21	6,058		6,058	6,100	86,600	175,000	31,231
Swisshelm	1		276	4		4	1,156		1,156		82,000		7,112
Tombstone	4		3,996	109		109	15,563		15,563	15,600	429,200		49,100
Turquoise	5		625	23		23	2,340		2,340	5,400	92,400		10,101
Warren	3		1,201,179	57,042		57,042	2,252,250		2,252,250	101,572,900	1,424,400	2,040,000	17,129,697
Coconino County:													
Havasu Canyon	1		156				2,267		2,267		175,600		14,782
Jacob Canyon and Warm Springs	3		4,844	13		13	1,236		1,236	458,500			60,939
Kaibito Plateau	1		261				346		346	48,500			6,551
Gila County:													
Banner and Dripping Springs	5		33,174	120		120	14,670		14,670	1,168,000	685,000	814,000	305,759
Globe-Miami	15		12,194,897	2,341		2,341	107,131		107,131	201,026,600	147,800		26,302,660
Mazatzal Mountains	1		8	2		2	14		14	100			93
Pioneer (Pinal Mountains)	1		20	2		2	156		156	1,100			324
Summit	1		48	3		3	232		232	1,200			426
Graham County:													
Aravaipa	3		443	5		5	1,440		1,440	7,200	79,400	65,000	15,110
Lone Star	1		1,072	52		52	173		173	60,800			9,847
Greenlee County:													
Ash Peak	2		18,540	651		651	136,260		136,260				119,681
Copper Mountain (Morenci)	4		9,659,209	3,986		3,986	195,248		195,248	168,694,400	1,400		22,208,730
Metcalf (Greenlee)	1		86	40		40	412		412	600			1,771
Maricopa County:													
Big Horn	1		4							300			39
Cave Creek and Camp Creek	2		3	4		4	14		14	200			176
Ellsworth (Harqua Hala)[1]	1		1								200		15
New River	1		4,998	67		67	1,402		1,402	446,600			61,400
Osborn	2		4,849	372		372	9,121		9,121	87,900	354,600		57,528
Vulture	6		16,696	455		455	2,177		2,177	2,600	342,200		43,476
Wickenburg	1		1,436	321		321	651		651	2,400	4,600		12,355

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1943, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Mohave County:													
Bentley	1		27				59		59	11,600	200		$1,565
Cedar Valley	2		1,409	2		2	315		315	11,800	1,600		1,948
Chemeheuvis		1			2	2							70
Cottonwood	1		1,177	137		137	360		360	36,000			9,731
Hacks Canyon	1		226	1		1	284		284	11,400			1,719
Indian Secret (White Hills)	1		250	2		2	706		706				572
Maynard and McConnico	1		62	7		7	436		436	100	3,000		793
Music Mountain	1		11	25		25	52		52		400		942
Owens	6		1,384	143		143	533		533	45,800			11,338
Prospect Canyon	1		41				69		69	6,800			933
San Francisco (Oatman, Goldroad, Katherine, Vivian)	1		20,825	2,960		2,960	8,062		8,062				109,333
Wallapai	12		43,724	1,922		1,922	88,695		88,695	236,500	2,784,800	3,084,000	703,019
Pima County:													
Ajo	1		8,956,698	45.108		45,108	478,284		478,284	140,138,000			20,136,833
Amole	2		909	41		41	758		758	18,000	50,400	10,000	9,174
Arivaca	1	1	70	72	2	74	291		291				2,797
Baboquivari	1		467	14		14	1,897		1,897	15,000			3,789
Cababi (Comobabi)	1		4	7		7	45		45		200		292
Cerro Colorado	1		1				52		52				37
Empire	1		115							1,000	4,000	75,000	8,530
Greaterville		1			2	2							70
Helvetia (Rosemont)	11		3,639	27		27	5,549		5,549	309,600	26,200	41,000	51,532
Meyer	1		52				187		187	300	7,800		757
Old Hat [2]	2		11,818	21		21	11,191		11,191	736,800			104,477
Pima (Sierritas, Papago, Twin Buttes)	7		16,995	35		35	53,768		53,768	121,400	1,156,400	2,780,000	442,212
Roskruge and Waterman	1		1,159	4		4	6,113		6,113	80,600	28,000		17,065
Silver Bell	1		663	5		5	5,099		5,099	8,300	66,000		9,830
Pinal County:													
Bunker Hill	2		865	2		2	211		211	107,800			14,234
Casa Grande	1		250	1		1							35
Cottonwood and Black Mountain	2		8	5		5	31		31	500			262
Dripping Springs	1		19				7		7	1,400			187
Martinez Canyon	1		404	2		2	488		488	600	138,200		10,860
Mineral Creek	2		2,353,260	689		689	64,928		64,928	74,868,400			9,803,178
Mineral Hill	4		98	7		7	90		90	1,900	10,000		1,306
Old Hat [2]	3		132,439	16,164		16,164	50,947		50,947	421,700	6,280,400	4,900,000	1,657,020
Pioneer (Superior)	6		417,429	9,140		9,140	476,751		476,751	37,640,000	248,800	8,144,000	6,450,335
Summit	2		159				7		7	7,700			1,006
Vekol	1		215	16		16	360		360	1,000	13,600		1,966

Santa Cruz County:													
Harshaw	5	--------	61,252	81	--------	81	204,404	--------	204,404	151,900	6,991,000	6,795,000	1,426,121
Oro Blanco	1	--------	861	84	--------	84	16,837	--------	16,837	1,400	--------	--------	15,095
Palmetto	1	--------	49	--------	--------	--------	--------	--------	--------	2,400	--------	--------	312
Patagonia	6	--------	32,411	29	--------	29	92,271	--------	92,271	842,200	1,066,000	3,862,000	673,162
Tyndall	4	--------	519	23	--------	23	3,167	--------	3,167	6,000	182,000	--------	17,487
Wrightson	1	--------	9	--------	--------	--------	52	--------	52	100	4,000	--------	350
Yavapai County:													
Agua Fria	5	--------	6,889	11	--------	11	969	--------	969	314,300	--------	--------	41,933
Big Bug	7	1	82,312	6,782	78	6,860	244,184	7	244,191	319,900	2,290,400	6,017,000	1,276,950
Black Canyon	4	1	105	41	2	43	1,260	--------	1,260	200	1,000	--------	2,502
Black Hills	1	--------	109	1	--------	1	1,156	--------	1,156	3,800	--------	--------	1,351
Black Rock	3	--------	124	31	--------	31	7	--------	7	4,200	--------	--------	1,636
Blue Tank	2	2	745	4	3	7	45	--------	45	25,200	--------	--------	3,553
Bullard (Pierce)	2	--------	728	99	--------	99	239	--------	239	29,800	--------	--------	7,509
Castle Creek	4	--------	11	2	--------	2	31	--------	31	1,200	4,000	--------	548
Cherry Creek	1	--------	64	39	--------	39	21	--------	21	--------	--------	--------	1,380
Copper Basin	5	--------	11,634	1	--------	1	343	--------	343	530,900	11,600	27,000	73,082
Eureka	7	--------	376,466	31	--------	31	14,836	--------	14,836	7,037,100	25,000	48,000	933,517
Hassayampa	6	2	135	24	7	31	502	--------	502	5,300	400	1,000	2,269
Kirkland	1	--------	34	11	--------	11	--------	--------	--------	--------	--------	--------	385
Lynx Creek	--------	2	--------	--------	8	8	--------	--------	--------	--------	--------	--------	280
Martinez	2	--------	1,142	317	--------	317	457	--------	457	300	--------	--------	11,459
Pine Grove	2	1	4,845	1,563	1	1,564	12,891	--------	12,891	21,500	111,600	303,000	107,796
Pocket Creek	--------	1	--------	--------	179	179	--------	7	7	--------	--------	--------	6,270
Tiger	2	--------	580	272	--------	272	1,589	--------	1,589	6,200	9,000	16,000	13,859
Tip Top	1	--------	6	2	--------	2	31	--------	31	--------	2,200	--------	257
Verde	5	--------	898,699	18,117	--------	18,117	1,036,194	--------	1,036,194	68,467,100	--------	--------	10,271,667
Walker	8	2	1,027	501	5	506	3,721	--------	3,721	4,600	142,000	35,000	35,384
Weaver	3	1	857	578	19	597	332	--------	332	--------	--------	--------	21,131
White Picacho	2	--------	221	4	--------	4	2,572	--------	2,572	400	29,800	--------	4,256
Yuma County:													
Castle Dome	3	--------	27,060	12	--------	12	20,731	--------	20,731	1,700	1,842,000	--------	153,533
Cienega	5	--------	1,076	211	--------	211	21	--------	21	45,500	--------	--------	13,315
Dome (Gila City)	--------	1	--------	--------	6	6	--------	--------	--------	--------	--------	--------	210
Ellsworth (Harqua Hala) [1]	9	--------	3,876	270	--------	270	443	--------	443	19,700	2,600	--------	12,521
Plomosa	6	1	1,193	141	4	145	46,277	--------	46,277	8,100	1,400	--------	39,141
Santa Maria (Planet, Bill Williams)	1	--------	334	--------	--------	--------	45	--------	45	33,000	--------	--------	4,322
Total Arizona	274	19	36,630,788	171,491	319	171,810	5,713,875	14	5,713,889	806,362,000	27,454,000	39,354,000	121,212,902

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[1] Ellsworth district lies in both Maricopa and Yuma Counties.

[2] Old Hat district lies in both Pima and Pinal Counties.

Comment on districts with small production has been omitted owing to lack of space.

COCHISE COUNTY

California district (*Hilltop*).—A lessee operated the Crosby mine near Portal for a short time in 1943 and shipped 108 tons of crude copper ore to a smelter; 3 tons of lead ore were produced from the Last Chance claim.

Cochise district.—The old Centurion mine at Dragoon was taken over in 1943 by the Captain Copper Co. A Reconstruction Finance Corporation loan of $5,000 enabled the company to clean out and rehabilitate the underground workings of the mine, and during the year 193 tons of carbonate copper ore were shipped to a smelter.

Dos Cabezas and Tevis district.—Mining operations at the Tout group near Dos Cabezas during the last 3 months of 1943 produced 79 tons of copper ore; a small lot (5 tons) of gold ore from the Gold Prince mine was sold to an ore buyer in Douglas.

Golden Rule (*Dragoon*) *district.*—The total output of the Golden Rule district in 1943 was 216 tons of zinc-lead ore from the Scenica mine and 195 tons of zinc ore from the Dragoon Zinc mine shipped to the Shattuck Denn custom mill at Bisbee.

Hartford (*Huachuca Mountains*) *district.*—Mining operations at the State of Texas mine near Hereford produced 832 tons of zinc-lead ore in 1943, which was shipped to the Shattuck Denn custom mill at Bisbee; crude lead ore (91 tons) produced from the Armistice property was shipped direct to a smelter.

Swisshelm district (*Elfrida*).—Lessees operated the Scribner mine during the first 2 months of 1943 and shipped 276 tons of silver-lead ore to the smelter at El Paso, Tex.

Tombstone district.—The principal output in the Tombstone district in 1943 was silver-lead ore (3,729 tons) from the Tombstone Extension mine, operated throughout the year by lessees; part (890 tons) of the ore was treated by gravity concentration, and the remainder (2,839 tons) was shipped direct to a smelter. Silver-lead ore was shipped also from the Mustang and Tombstone properties, and 60 tons of old waste-dump ore (lead) from the San Diego property were treated by gravity concentration.

Turquoise district (*Courtland, Pearce, Gleeson*).—Approximately 625 tons of ore were produced in the Turquoise district in 1943; most (495 tons) of it was crude silver-lead ore from the Defiance mine near Gleeson, and the rest was mainly silver-copper ore (55 tons) from the Black Diamond mine and lead ore (46 tons) from the Tom Scott mine.

Warren district (*Bisbee, Warren*).—The total output of ore in the Warren district was 1,201,179 tons in 1943 compared with 1,210,176 tons in 1942; the principal output continued to be copper ore from the Copper Queen branch of the Phelps Dodge Corporation. The company reported that 1,126,838 tons of copper ore were shipped direct to the smelters at Douglas and Clarkdale; these shipments included 143,657 tons of low-grade marginal ore mined for the account of Metals Reserve Co. and sent to Clarkdale for treatment, and 247,418 tons of siliceous flux ore produced from the "Southeast Extension" porphyry ore body for the Douglas smelter. In addition 917 tons of copper precipitates were produced by the surface and underground precipitation plants, and 6,135 tons of zinc-lead ore were shipped to the Shattuck Denn custom mill at Bisbee.

According to the company printed annual report for 1943, exploration and development during the year comprised 49,049 feet of drifting, crosscutting, and raising, 7,323 feet of stope preparation, and 22,552 feet of diamond drilling. Ore developments resulting from the exploration and development were satisfactory, particularly in the extension of known ore bodies. Further development of zinc-lead ores in mineralized areas east of the Campbell fault gives encouragement for the future exploration of these areas. The Cole division continued to open up satisfactorily, and extensions to the main ore body were found on the 1,100 and 1,300 levels.

The Shattuck Denn Mining Corporation operated its Denn mine and 150-ton flotation mill at Bisbee continuously; the mill treated principally zinc-lead ores received from custom shippers. In all, 20,253 tons of ore (including 4,255 tons from the Denn mine) were treated in 1943 (containing an average of 0.02 ounce of gold and 3.17 ounces of silver to the ton, 0.74 percent copper, 6.43 percent lead, and 12.65 percent zinc) and yielded 2,057 tons of lead-copper concentrates and 3,581 tons of zinc concentrates. In addition to the 4,255 tons of zinc-lead ore, 59,710 tons of copper ore were produced from the Denn mine and shipped to the smelter at El Paso, Tex. The rest of the district output was mainly copper ore (3,843 tons) and lead ore (343 tons) shipped from the Shattuck mine by lessees.

COCONINO COUNTY

Havasu Canyon (Supai) district.—The Johnson mine on Havasu Creek 1½ miles below Supai was operated in 1943 by the Havasu Lead & Zinc Mining Co.; 156 tons of high-grade silver-lead ore were shipped to the smelter at El Paso.

Jacob Canyon and Warm Springs district.—The output of 4,844 tons of ore in the Jacob Canyon and Warm Springs district in 1943 was carbonate copper ore shipped to smelters; all but 8 tons were mined by a power shovel from shallow surface pits at the Mackin-Kennedy-Ryan group and the Petoskey group by the Apex Mining Co.

Kaibito Plateau district.—Lessees operated the Mardun property 57 miles north of Cameron in 1943 and shipped 261 tons of carbonate copper ore to the smelter at Clarkdale.

GILA COUNTY

Banner and Dripping Springs district.—The Sam Knight Lease operated the Christmas mine near Winkelman throughout 1943 and shipped 27,330 tons of crude copper ore to the smelter at Hayden; the ore averaged only 2.08 percent copper, but it is greatly desired by the smelter owing to its high silica content. The rest of the district output was mainly zinc-lead ore (5,327 tons) from the "79" mine shipped to the Shattuck Denn custom mill at Bisbee and copper ore (438 tons) shipped direct to a smelter from the Columbia property.

Globe-Miami district.—The Globe-Miami district, with a production of 201,026,600 net pounds of copper in 1943 (188,529,000 net pounds in 1942), remained the chief copper-producing area in Arizona. The Inspiration property, with a yield of 110,259,203 net pounds of copper, was again the outstanding producer of copper in the district and ranked third in the State. The Inspiration Consolidated Copper Co. reported that 3,721,926 tons of ore, averaging 1.20 percent copper, from which the slimes had been removed, were treated by ferric sulfate leaching; the slimes (306,626 tons averaging 1.546 percent copper) removed from the ore and 1,149,155 tons of additional crude ore, averaging 1.165 percent copper, were treated at the concentrator to recover the sulfide copper, and the tailings were treated with sulfuric acid to dissolve the oxide copper. In addition, 4,409 tons of crude copper ore, 249 tons of leaching-plant cleanings, and 69 tons of mine-water precipitates were shipped direct to the International smelter at Miami.

According to the printed annual report of the company for 1943, ore mined during the year totaled 5,182,116 dry tons assaying 1.213 percent copper, of which 0.634 percent was oxide copper and 0.579 percent sulfide. The average quantity of ore mined per working day was 16,663 tons or 24.23 tons per man-shift, compared with 26.91 tons per man-shift in 1942 and 32.51 tons in 1941. The low rate per man-shift in 1943 was largely due to inefficiency of available labor. It was impossible to maintain maximum production throughout the year owing to an acute shortage of labor in both the mining and metallurgical departments. With the assistance of Government agencies, every effort was made to recruit labor. The shortage in the mining department was somewhat alleviated by the assignment of men furloughed from the Army. Many of these men, however, were unfamiliar with metal-mining practices. The shortage in the metallurgical department was virtually unrelieved. Underground development during the year totaled 67,173 feet of drift and raises and 6,887 cubic yards of miscellaneous excavation.

The Miami Copper Co. operated its mine, 18,000-ton concentrator, and 3,000-ton leaching plant continuously; 5,273,828 tons (5,922,250 tons in 1942) of ore, averaging 0.715 percent copper, were treated by the leach-float process; and 6,073 tons of copper precipitates were produced from leaching in place. Molybdenum concentrates were recovered as a byproduct in treating copper ore.

According to the company printed annual report for 1943 the combined production of Miami Copper Co. and of Castle Dome Copper Co., Inc., its wholly owned subsidiary, was 88,706,828 net pounds of copper in 1943; Miami produced 70,686,762 and Castle Dome 18,020,066 net pounds. This combined production, accomplished despite the manpower shortage, exceeded the production of the company in any year in its history. Mining at the Miami mine was continuous throughout the year in the sulfide ore body; but operations in the mixed ore body, which began in July 1934, ceased May 7, 1943, when the ore body was completely mined out. Leaching of broken gob in abandoned portions of the mine produced a substantial quantity of copper. Mine development during the year comprised 23,846 feet of drifts and 25,055 feet of raises. In addition, 40,350 feet of drift and raises were driven for stoping account. Although every effort was made to operate the property at full capacity, a shortage of labor held mine production down to approximately 90 percent. The 10,000-ton flotation plant and all its necessary facilities, erected for and owned by Defense Plant Corporation and leased to the Castle Dome Copper Co., Inc., were ready for operation June 10, 1943.

Under the lease agreement the Castle Dome Copper Co., Inc., took over the plant and facilities June 10, 1943, and began milling copper ore. During the remainder of the year the plant treated 1,714,205 tons of ore averaging 0.612 percent copper. Net recoveries from treatment of this ore were 546 ounces of gold, 27,601 ounces of silver, and 18,020,066 pounds of copper. The mill is now (March 1944) treating about 11,000 tons of copper ore a day. The ore body has been stripped and mined on benches or levels of 40 feet vertical depth. To the end of 1943, 13 of these benches have been worked of a total vertical depth of 550 feet. On the lowest bench now being operated on the 4,265-foot level, the depth of the bench was increased from 40 to 45 feet to determine whether it would be more economical to operate the electric shovels against a higher face.

The rest of the district output was largely copper ore (13,567 tons) shipped direct to a smelter from the Carlota mine by the Carlota Copper Co. and similar ore (10,787 tons) from the Old Dominion, Superior & Boston, and Van Dyke properties.

GRAHAM COUNTY

Aravaipa district.—The principal output in the Aravaipa district in 1943 was 357 tons of zinc-lead ore from the Aravaipa group shipped by the Athletic Mining Co. to the Shattuck Denn custom mill at Bisbee.

Lone Star district.—Mining in 1943 at the Horseshoe mine near Safford was continuous from May 15 to the end of the year, resulting in the shipment of 1,072 tons of crude copper ore.

GREENLEE COUNTY

Ash Peak district (Duncan).—Lessees operated the Ash Peak mine throughout 1943 and shipped 18,320 tons of siliceous silver fluxing ore to the International smelter at Miami; 220 tons of similar ore from the Hardy mine were shipped to the same smelter.

Copper Mountain district (Morenci).—Mining, milling, and smelting at the Morenci branch of the Phelps Dodge Corporation were continuous throughout the year. The company reported that 9,577,595 tons of copper ore were treated in the 25,000-ton concentrator, and that 74,721 tons of crude copper ore, 6,521 tons of copper precipitates, and 5,443 tons of old Clifton smelter cleanings were shipped direct to the Morenci smelter; the output was much greater than in 1942.

According to the annual report of the Phelps Dodge Corporation for 1943, the Morenci open pit had its first full year of steady operation and became the corporation's largest copper-producing branch. Operations in the pit were carried on at a greatly increased rate, made necessary by the Morenci expansion program. At the close of 1943 the pit had been prepared for a daily production of 45,000 tons of copper ore, which is the designed capacity of the combined Phelps Dodge and Defense Plant Corporation concentrators. A total of 40,756,353 tons of material was moved during the year, comprising 9,652,316 tons of ore and 31,104,037 tons of waste. One new bench was opened, and at the end of the year 16 benches were available for mining. Construction on the extension to the concentrator and to the smelter continued throughout the year; however, the work at the smelter seriously interfered with routine smelting operations. This construction of new plant facilities for the expansion program was nearing completion at the close of the year; the entire new plant was placed in full operation February 14, 1944. The cost of the expansion has been borne by the Defense Plant Corporation.

The rest of the district output was principally crude high-silica oxide-copper ore (1,284 tons) from the Keating mine, operated under lease by the Auto Specialties Manufacturing Co., and crude high-silica gold ore (162 tons) from the Climax (Emma Gomez) property.

Metcalf (Greenlee) district.—The Victory Mining Co., Inc., operated the Parrot (formerly Polaris) property near Clifton in 1943 and shipped 86 tons of gold ore to the smelter at El Paso.

MARICOPA COUNTY

New River (Moors) district.—About 5,000 tons of sulfide copper ore were shipped in 1943 from the Orizaba mine by the Orizaba Mining Co.; the ore averaged 5.10 percent copper.

Osborn district.—A total of 2,454 tons of gold-silver-copper-lead ore was shipped in 1943 from the Belmont-McNeil group 25 miles north of Dixie. This group was operated under lease the first 7 months of the year by Reed & Reed and the last 5 months by the East Vulture Mining Co. The East Vulture Mining Co. also operated the Moon Anchor mine in 1943 and shipped 1,595 tons of lead ore to a smelter and treated 800 tons of similar ore in a flotation mill.

Vulture district.—The principal output in the Vulture district in 1943 was 16,349 tons of old waste-dump gold ore from the Vulture property treated by flotation. The remainder of the district output was largely 288 tons of lead ore produced from the Montezuma mine.

Wickenburg district.—Various operators on an old tailings dump at Wickenburg shipped a total of 1,436 tons of gold material in 1943.

MOHAVE COUNTY

Bentley (Grand Wash) district.—Lessees operated the Grand Gulch mine in 1943 and shipped 27 tons of carbonate ore, averaging 22.14 percent copper, to a smelter.

Cedar Valley district.—Mining and milling operations at the Boriana tungsten mine near Yucca were much reduced in 1943; the 200-ton concentration mill ran 95 hours in January, 75 hours in February, and 56 hours in September and treated a total of 1,314 tons of tungsten-copper ore yielding 30 tons of copper concentrates and some tungsten concentrates. The remainder of the district output was 95 tons of crude copper ore shipped from the Antler mine.

Cottonwood district.—The Copper Giant mine near Hackberry was worked the first 7 months of 1943 by lessees and the last 5 months by the owner (Henry Galbraith); a total of 1,177 tons of gold-copper ore was shipped to the smelter at Clarkdale.

Hacks Canyon district.—Five cars (226 tons) of carbonate copper ore were shipped in 1943 from the Hacks Canyon mine south of Fredonia by the Canyon Copper Co.

Indian Secret (White Hills) district.—About 250 tons of waste-dump ore (silver) from the White Hills property, 45 miles north of Chloride, were cyanided in 1943.

Maynard district.—Lessees operated the Gold King group in 1943 and shipped 34 tons of gold-silver ore to a smelter and treated 28 tons of similar ore by gravity concentration.

Music Mountain district.—About 11 tons of rich gold ore were produced in 1943 from the Saddleback claim near Valentine.

Owens (McCracken and Potts Mountain) district.—The principal output in the Owens district in 1943 was 1,240 tons of gold-copper ore shipped direct to a smelter from the Cleopatra mine by various lessees. The remainder of the district output was largely 92 tons of copper ore from the Iron Clad, Panther Claw, and Stein properties.

Prospect Canyon district.—Carbonate ore (41 tons), averaging 8.78 percent copper and containing a little silver, was shipped in 1943 from the Phillips & Stout property 47 miles northeast of Peach Springs.

San Francisco (Oatman, Goldroad, Katherine, Vivian) district.—During the decade 1933–42, mines in the San Francisco district produced an average of 36,979 ounces of gold a year; in 1941 the output was 42,098 ounces, in 1942 it was 28,570 ounces, and in 1943 it dropped to 2,960 ounces. All the output in 1943 came from the Tyro mine at Katherine, operated by the Gold Standard Mines Corporation; however, the mine and 300-ton Katherine cyanide plant were permanently closed April 15. The Goldroad mine at Goldroad, largest producer of gold in the district from 1937 to 1942, inclusive, was idle in 1943 owing to the Government gold-mine closing order of October 1942.

Wallapai district (Cerbat, Chloride, Mineral Park, Stockton Hill).—The output of the Wallapai district in 1943 comprised 40,824 tons of zinc-lead ore, 2,100 tons of copper ore, 385 tons of lead ore, 323 tons of gold ore, and 92 tons of zinc ore. All the copper ore was carbonate material shipped direct to a smelter from the Emerald Isle mine, and all the zinc ore came from the Columbus mine; the gold ore was produced from two properties—the Flores and Minnesota-Connor; nearly all (376 tons) of the lead ore came from the Samoa mine, operated by lessees; and 94 percent of the zinc-lead ore was produced from the Tennessee mine at Chloride. The Tennessee-Schuylkill Corporation operated the Tennessee mine and its 150-ton flotation mill throughout the year; the mill treated 38,286 tons of ore (averaging 0.04 ounce of gold and 2.01 ounces of silver to the ton, 0.10 percent copper, 3.70 percent lead, and 5.65 percent zinc), which yielded 3,015 tons of lead concentrates and 3,100 tons of zinc concentrates. Other producers of zinc-lead ore were the De La Fountaine, Minnesota-Connor, Silver Hill, Silver Monster, and Summit properties; nearly all the ore from these properties was shipped to a custom mill in Utah.

PIMA COUNTY

Ajo district.—Mining and milling at the New Cornelia property were continuous and at capacity throughout the year; the 25,000-ton concentrator treated 8,956,698 tons of copper ore in 1943 compared with 8,324,033 tons in 1942. The property has ranked first in output of copper in Arizona for the past several years, but in 1943 the Morenci branch of the Phelps Dodge Corporation took first place. According to the annual report of the Phelps Dodge Corporation for 1943, the New Cornelia open pit produced 8,961,111 tons of copper ore and 6,700,804 tons of waste; operations were of a routine nature and followed the schedule made necessary by the increased scale of production.

Amole district.—The Old Yuma mine west of Tucson was operated under lease in 1943 by the Tucson Ore Milling Co.; 353 tons of zinc-lead ore were shipped to a smelter, and 270 tons of similar ore were treated in a concentration mill. The remainder of the district output was 286 tons of copper ore shipped from the Mile Wide mine to the smelter at Hayden.

Arivaca district.—Leasing operations at the Oreona mine during the first 5 months of 1943 produced 70 tons of fairly rich gold ore; 2 ounces of placer gold were recovered from gravel in gulches near Arivaca.

Baboquivari district.—In 1943 various lessees worked at the Papago Chief mine 65 miles southwest of Tucson; a total of 467 tons of gold-silver-copper ore was shipped to the smelter at Hayden.

Empire district.—E. P. Hilton, owner of the Chief mine near Vail, shipped 8 tons of high-grade carbonate zinc-lead ore to the smelter at El Paso in 1943 and 107 tons of high-grade carbonate zinc ore to a zinc smelter at Blackwell, Okla.

Helvetia (Rosemont) district.—The output of the Helvetia district in 1943 comprised 3,388 tons of copper ore shipped direct to a smelter and 145 tons of zinc-lead ore and 106 tons of zinc-copper ore shipped to the Shattuck Denn custom mill at Bisbee. Nearly half of the copper ore came from the Copper World (Leader) mine, worked by various lessees; 1,073 tons of the copper ore and the 106 tons of zinc-copper ore came from the Rosemont mine; and all the zinc-lead ore was produced from the Daylight and Sulphide Lead-Zinc properties. Other producers of copper ore included the Coconino, Graveyard, Last Chance No. 2, Mohawk, and Newman mines.

Meyer (Gunsight) district.—Lessees operated the Gunsight mine a short time in 1943 and shipped 52 tons of low-grade silver-lead ore to a smelter.

Old Hat district (Oracle).—The Daily and Geeseman groups and the 100-ton flotation mill on the property were purchased June 26, 1943, by the Control Mines Co. from Control Mines, Inc. A total of 11,676 tons of copper ore was treated by flotation during the year from operations of both companies. The remainder of the district output was 142 tons of high-grade copper ore shipped direct to a smelter from the Giant claim.

Pima (Sierritas, Papago, Twin Buttes) district.—One of the most important mining events in Arizona in 1943 was the initiation in September of milling at the San Xavier mine 20 miles southwest of Tucson by the Eagle-Picher Mining & Smelting Co. The company reported that during the last quarter of the year the new 150-ton flotation mill treated 14,057 tons of ore (averaging 3.09 ounces of silver to the ton, 0.50 percent copper, 4.94 percent lead, and 11.02 percent zinc), which yielded 964 tons of lead-copper concentrates and 2,176 tons of zinc concentrates. The remainder of the district output was mainly 2,578 tons of zinc ore and zinc-lead ore from the San Xavier Extension mine and waste dump shipped to custom mills in Arizona and New Mexico by the Chilson Mines Co. and 338 tons of zinc-lead ore from the Esperanza, High Hill, and Olivette properties.

Roskruge and Waterman (Silver Hill) district.—A. R. Byrd, Jr., leased the Silver Hill mine early in 1943 and during the year shipped

979 tons of copper ore and 180 tons of lead-copper ore to smelters in Arizona and Texas.

Silver Bell district.—Lessees worked at the Indiana-Arizona Copper Co. property in 1943 and shipped 663 tons of low-grade silver-lead ore to the smelter at El Paso.

PINAL COUNTY

Bunker Hill district (*Copper Creek*).—All the output in the Bunker Hill district in 1943 was crude copper ore (865 tons) shipped to a smelter; 793 tons were produced from the Magma Chief mine and 72 tons from the Mammoth Butte mine.

Martinez Canyon district.—Development throughout the year at the Silver Bell-Martinez group by the California Steel Products Co. resulted in the shipment of 7 cars (404 tons) of crude lead ore.

Mineral Creek district (*Ray*).—Mining operations at the Ray mine of the Nevada Consolidated Copper Corporation (subsidiary of the Kennecott Copper Corporation) were at a lower rate in 1943 than in 1942, resulting in a decrease in output of copper ore from 2,969,268 to 2,351,900 tons. The company 12,000-ton concentrator at Hayden operated continuously and treated 2,343,204 tons of ore averaging 1.589 percent copper. In addition, 8,696 tons of crude copper ore and 7,071 tons of copper precipitates were shipped direct to the smelter at Hayden. According to the annual report of the Kennecott Copper Corporation for 1943, a shortage of underground labor of all classes adversely affected mine operations at the Ray property, although copper production was maintained at a level well above its pre-war rate of output. Sufficient development was done to keep pace with ore production.

The remaining district output was 1,360 tons of copper ore produced from an open pit at the Copper Butte property.

Mineral Hill district.—The output of the Mineral Hill district in 1943 comprised 12 tons of copper ore from the Blue Crystal claim, 11 tons of high-grade lead ore from the Orphan Boy claim, and 75 tons of gold ore from waste dumps of the Sunset and Wedge properties.

Old Hat district (*Oracle*).—Virtually all the output in the Old Hat district (Pinal County) in 1943 was 83,986 tons of oxide gold-silver-lead-molybdenum-vanadium ore and 48,411 tons of sulfide zinc-lead ore produced from the Mammoth-Collins and New Year-Mohawk groups by Mammoth-St. Anthony, Limited. The output of oxide ore was much less than in 1942, but the output of sulfide ore was much greater. The company reported that the oxide ore was treated by gravity concentration, followed by flotation (flotation tailings were treated by cyanidation), and that the sulfide ore was treated by straight flotation. The oxide lead concentrates (1,995 tons) were smelted in the company 20-ton lead furnace, and the sulfide lead concentrates (3,948 tons) and the sulfide zinc concentrates (6,481 tons) along with some high-grade gold-iron concentrates (117 tons) were shipped to smelters in Texas. Gold precipitates, as well as molybdenum and vanadium products and lead bullion, were shipped East.

Pioneer district (*Superior*).—Mining, milling, and smelting at the Magma property of the Magma Copper Co. were continuous throughout the year, except for brief shut-downs to allow for repairs. The output of gold, silver, copper, and lead was less than in 1942, but the output of zinc was slightly greater. The company reported that 269,210 tons of copper ore and 84,571 tons of zinc-copper ore were treated in the 850-ton concentrator, and 60,402 tons of copper ore along with 94,619 tons of copper concentrates recovered from copper ore and 10,269 tons of copper concentrates recovered from zinc-copper ore were sent to the company 450-ton smelter. The zinc concentrates (9,084 tons) were shipped to Amarillo, Tex. The property was the largest producer of zinc in the State in 1943.

According to the company printed annual report, the average net cost of producing copper after deduction of gold, silver, and zinc concentrate values was 10.28 cents a pound in 1943 compared with 9.66 cents in 1942. Development in 1943 comprised 4,458 feet of drifting, 6,818 feet of raising, 278 feet of sinking, and 3,246 feet of cross cutting. It was necessary to drastically curtail the usual amount of development early in the year, owing to shortage of labor. Beginning with the latter part of March, production decreased slowly until in October the tonnage mined reached a lower point than for any full month's operation since November 1938. The drop in production was due principally to the continued loss of skilled employees to the higher wage-paying war industries, inability to obtain sufficient replacements, and the inexperience and, in many cases, inefficiency of the replacements procured. Gold and silver values in the copper ore continue to decrease as more ore is mined from the lower levels. Also, operating conditions are becoming increasingly difficult owing to heavier ground and higher rock temperatures on the lower levels.

The remainder of the district output was mainly 2,960 tons of siliceous silver ore from the Reymert mine shipped by Reymert Lease to the International smelter at Miami.

Summit district.—Copper ore (159 tons) was produced in 1943 from two mines west of Miami in the Summit district; 114 tons came from the Copper Flat mine and 45 tons from American Mines.

Vekol district.—The output in the Vekol district in 1943 was 215 tons of lead ore produced from the Hilltop mine, 45 miles southwest of Casa Grande.

SANTA CRUZ COUNTY

Harshaw district.—The principal output in the Harshaw district in 1943 was 60,814 tons of zinc-lead-silver ore produced from the Trench and Flux groups by the American Smelting & Refining Co.; however, the output was 21 percent less than in 1942 and the ore was of lower grade. It was treated by flotation in the company 200-ton mill and yielded 5,290 tons of lead-silver concentrates and 6,775 tons of zinc concentrates. The rest of the district output comprised 258 tons of silver-lead ore from the Hardshell mine, 93 tons of zinc-lead ore from the Blue Nose Extension mine, and 87 tons of silver ore from the American and Salvador properties.

Oro Blanco district (Ruby).—The output in the Oro Blanco district in 1943 was 861 tons of siliceous silver ore shipped from the Brick claim to smelters in Arizona.

Patagonia (Duquesne) district.—The Duquesne property of the Callahan Zinc-Lead Co. continued in 1943 to be a large producer of zinc-lead-copper ore, and during the year 26,739 tons of ore from this mine were treated in the company 140-ton flotation mill. In addition, the mill treated 4,255 tons of custom ore from two properties in the district—4,206 tons of zinc-copper ore from the Pride of the West mine and 49 tons of copper ore from the Santo Nino mine. The total output from the mill was 1,213 tons of copper concentrates, 713 tons of lead-copper-silver concentrates, and 4,086 tons of zinc concentrates. The remainder of the district output was chiefly 1,267 tons of silver-lead ore shipped by lessees from the Mowry mine and waste dump to the smelter at El Paso.

Tyndall district.—Lessees worked at four mines in the Tyndall district in 1943 and shipped a total of 519 tons of ore; 492 tons of it was silver-lead ore from the Alto, Jefferson, and San Ramon properties.

YAVAPAI COUNTY

Agua Fria district.—Mining operations at the Binghampton mine 6 miles east of Mayer produced 6,231 tons of copper ore in 1943, which was shipped direct to a smelter. Copper ore was shipped also from the Burzog (Old Minor), Burlington, Stoddard, and Yaller Kid properties.

Big Bug district.—The Iron King mine at Humboldt, operated by the Shattuck Denn Mining Corporation, continued in 1943 to be a large producer of zinc-lead ore. During the first 6 months of the year about 35,650 tons of ore were treated by concentration, and the current gold-silver flotation tailings (26,735 tons) were treated by cyanidation; the cyanidation of tailings ceased in June, but during the last 6 months of the year 33,348 tons of zinc-lead ore were treated by straight concentration. In addition, 4,495 tons of crude gold ore were shipped direct to a smelter. The 240-ton flotation mill on the property treated a total of 75,366 tons of zinc-lead ore (including 6,368 tons of custom ores) in 1943, which yielded 3,922 tons of lead concentrates, 7,139 tons of zinc concentrates, and 5,795 tons of iron concentrates. Liberty Mines operated the Hackberry mine near Mayer throughout the year and shipped 5,742 tons of zinc-lead ore to the Iron King custom mill. The remainder of the district lode output was largely 2,500 tons of old copper tailings from the Humboldt tailing dump treated by concentration. The only placer output in the district was 78 ounces of gold and 7 ounces of silver recovered by sluicing at the Standard claim.

Black Canyon district.—The output in the Black Canyon district in 1943 was nearly all gold-silver ore (74 tons) from the Golden Turkey mine and silver ore (24 tons) from the Christmas and Thunderbolt properties.

Black Hills district.—A lessee operated the Shylock mine near Dewey in 1943 and shipped 109 tons of siliceous silver-copper ore to the smelter at Clarkdale.

Black Rock district.—Virtually all the output in the Black Rock district in 1943 was 122 tons of gold-copper ore produced from the Unida mine, 10 miles north of Wickenburg.

Blue Tank district.—Leasing operations at the Camp B mine near Wickenburg during 5 months of 1943 produced 743 tons of copper ore. Placer operators recovered 3 ounces of gold from claims along the Hassayampa River.

Bullard (Pierce) district.—Mining operations at the Bullard mine near Aguila began October 1, 1943, under a Reconstruction Finance

Corporation loan; during the last 2 months of the year 700 tons of gold-copper ore were shipped to the smelter at Hayden. Gold-copper ore (28 tons) was produced also from the Amazon claim.

Cherry Creek district.—A lessee operated the Bugler mine a short time in 1943 and shipped 64 tons of gold ore to the smelter at Clarkdale.

Copper Basin district.—The output in the Copper Basin district in 1943 comprised 11,463 tons of low-grade copper ore shipped direct to a smelter from the Commercial mine and 100 tons of zinc ore from the Boston-Arizona mine and 71 tons of zinc-lead ore from the Black Diamond, Silver Gulch, and U. S. Navy properties treated in the Iron King custom mill at Humboldt.

Eureka district.—Copper output in the Eureka district was much greater in 1943 than in 1942, owing to the completion in February of the new 2,500-ton flotation mill at the Bagdad mine. The old 250-ton mill continued operating until March 8, when the new mill began running; during the year a total of 375,715 tons of ore, averaging 1.26 percent copper, was mined and treated. The Bagdad Copper Corporation estimates that it has 6,000,000 tons of ore reserves and an additional 5,000,000 tons of indicated ore. The rest of the district output was mainly 374 tons of copper ore and 110 tons of zinc-lead ore from the Copper King mine and 210 tons of copper ore from the Copper Queen and Old Dick properties.

Hassayampa (*Groom Creek*, *Hassayampa River*, *Senator*, *Prescott*) *district.*—The principal output in the Hassayampa district in 1943 was 90 tons of copper ore from the Storm Cloud and Treadwell properties and 37 tons of gold ore from the Easy-to-Get claim.

Martinez (*Congress*) *district.*—Lessees worked at two properties in the Martinez district in 1943 and shipped a total of 1,142 tons of highly siliceous gold ore to the smelter at Hayden; 658 tons came from the Congress mine and 484 tons from the Niagara-Congress waste dump.

Pine Grove district (*Crown King*).—Zinc-lead-gold ore from the Gladiator-War Eagle group continued in 1943 to be the principal output in the Pine Grove district. About 4,800 tons of ore were treated in a 50-ton flotation mill and yielded 178 tons of high-grade lead-silver-gold concentrates, 94 tons of lead-copper concentrates, and 334 tons of zinc concentrates. The remainder of the district output was 45 tons of lead ore shipped direct to a smelter from the Del Pasco mine.

Pocket Creek district.—The Pocket Creek Placer was operated during the spring months of 1943, and 179 ounces of gold and 7 ounces of silver were recovered by sluicing.

Tiger district.—The output in the Tiger district in 1943 was 464 tons of zinc-lead ore from the Tiger mine treated by flotation and 116 tons of gold ore shipped direct to a smelter from the Pilgrim claim near Crown King.

Verde district (*Jerome*).—Mining, milling, and smelting were continuous throughout 1943 at the United Verde branch of the Phelps Dodge Corporation; however, the output of ore and old tailings decreased to 879,170 tons from 1,212,248 tons in 1942. A total of 613,681 tons of copper ore was treated in the 2,100-ton concentrator, and 265,489 tons of ore and old tailings and 354 tons of copper precipitates were shipped direct to the corporation smelter at Clarkdale.

According to the printed annual report of the corporation for 1943, mining at the United Verde mine was confined to the areas between the 1,650 and 3,300 levels (all copper areas above the 1,650 level have been abandoned), from which 749,619 tons of primary copper ore were produced compared with 1,015,202 tons in 1942. Approximately half of the 1943 output was low-grade ore not economic at a 12-cent copper price, but it was possible to mine this ore under a revised quota established October 1, 1942, under the premium-price plan. Exploration and development on the lower levels of the mine were prosecuted vigorously. A total of 66,678 feet of exploratory and development openings was driven, including 10,008 feet of drifting, 2,337 feet of raising, 642 feet of calyx drilling, and 53,691 feet of diamond drilling. Although all objectives have not been reached, no new ore was discovered as a result of the current deep-level exploration campaign.

The remainder of the district output was 14,992 tons of siliceous gold-silver ore from the Iron King-Equator group, shipped by lessees to the smelter at Clarkdale, and 4,537 tons of copper ore shipped to a smelter from the Dundee-Arizona, Florentis, and Verde properties.

Walker district.—Lessees worked at eight properties in the Walker district in 1943 and shipped 1,027 tons of ore and old slag; the total included 381 tons of zinc-lead ore from the New Strike mine, shipped to the Iron King custom mill at Humboldt, and 290 tons of old silver-lead slag from the Porter slag dump and 263 tons of high-grade gold-lead ore from the Champion, Emma, and Oro Plata properties, shipped direct to a smelter. Placer gold (5 ounces) was recovered from two claims on Lynx Creek near Walker.

Weaver district (Octave).—Gold production in the Weaver district decreased considerably in 1943, owing to the closing in 1942 of three large producers of gold ore—the Octave, Alvarado, and Yarnell properties. The lode output of the district comprised 435 tons of siliceous gold ore shipped direct to a smelter from the Monica mine and 422 tons of old mill cleanings and old tailings (containing chiefly gold) shipped by lessees from various mill sites; 19 ounces of placer gold were recovered from various claims along Weaver Creek and at Rich Hill.

White Picacho district.—Lessees worked the Diamond Joe mine near Wickenburg for a few months in 1943 and shipped 213 tons of silver-lead ore to the smelter at El Paso; 8 tons of gold-copper ore were produced from the Robertson claim.

YUMA COUNTY

Castle Dome district.—The output of silver and lead in the Castle Dome district was much greater in 1943 than in 1942, owing to a full year's operation at the DeLuce group by the Arizona Lead Co. The mill on the property, equipped with jigs and tables, treated 26,991 tons of oxidized lead ore; in addition, 62 tons of high-grade oxidized lead ore were shipped direct to a smelter. The remainder of the district output was small lots of similar ore produced from the Sonora and Union properties.

Cienega district.—Strategic Metal Mines operated the Empire-Arizona property, 12 miles east of Parker, throughout 1943 and shipped 774 tons of gold-copper ore to the smelter at Clarkdale. The rest of the district output was mainly 286 tons of gold-copper ore from the Billy Mack and Lion Hill properties.

Ellsworth district (*Salome*).—In 1943 about 3,500 tons of old tailings (gold) from the Bonanza & Golden Eagle dump were treated by cyanide leaching. The remainder of the district output was largely 227 tons of copper ore shipped from the Columbia and Yuma Copper properties and 105 tons of gold ore from the Bunker Hill and Odin mines.

Plomosa district.—The R. & A. Mines Co. operated (under lease) the R. & A. mine near Vicksburg in 1943 and shipped 976 tons of siliceous silver ore to the International smelter at Miami. The rest of the district lode output included 108 tons of siliceous gold ore shipped from the Little Butte mine and 108 tons of copper ore produced from the Apache and Moore properties. The Sax placer claim was operated for a short time in 1943, and 4 ounces of gold were recovered by drift mining.

Santa Maria (*Planet, Bill Williams*) *district.*—The only output in the Santa Maria district in 1943 was 334 tons of copper ore shipped direct to a smelter from the Swansea mine, operated under lease by the Swansea Development Co.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA

(MINE REPORT)

By Charles White Merrill

SUMMARY OUTLINE

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SUMMARY

California gold production in 1943 fell below that in any year since 1848—the year James A. Marshall made his historic discovery in the gravels of the American River near Coloma. Except for 1932 and 1933, silver production was the lowest in the twentieth century. However, copper production was the largest in both quantity and value since 1930; zinc was the largest in quantity and value since 1927; and lead was the largest in quantity and value since 1918. The total value of the five metals ($9,176,616) was the lowest since 1848. Higher wages, enlistment of miners in the armed forces, migration of miners to war industries, rising prices of supplies and equipment and difficulties in obtaining them, increased taxes, and the fixed prices for gold and silver were factors accelerating the downward trend, which was already under way in 1942. In addition, 1943 was the first year in which War Production Board Limitation Order L–208 affected operations for the whole year. During 1943, however, 38 grants were issued by the Board to California gold miners, which resulted in expanded production in some instances.

Comparing 1943 with 1942, gold decreased 83 percent and silver 58 percent in both quantity and value; copper increased 728 percent in quantity and 790 percent in value; lead increased 13 percent in quantity and 26 percent in value; and zinc increased 203 percent in quantity and 252 percent in value. The total value of the five metals was 71 percent less than in 1942; of the total value gold represented 57 percent, silver 5 percent, copper 25 percent, lead 9 percent, and zinc 4 percent.

The counties of the State, arranged by value of output of the five metals, were in very different order in 1943 from preceding years. Inyo County, which ranked seventh in 1942, was at the top of the list in 1943. Lead represented over half of the total value of metal output in Inyo County, and the value of each of the other four metals was also substantial. Siskiyou County, eighth on the list in 1942, advanced to second place in 1943; copper production at the Dakin (Gray Eagle) mine near Happy Camp was the principal factor in the county increase. Yuba County remained in third place, largely as the result of continued operation of some of its connected-bucket gold dredges.

Other counties of the leading 10, listed in order of total value of output, were: Nevada County (largely from gold ore including mill clean-ups), Calaveras County (largely from copper and gold-copper-zinc ores), Butte County (largely from connected-bucket dredges and from zinc ore), Sacramento County (almost entirely from connected-bucket dredging), Tuolumne County (largely from Eagle Shawmut mine gold ore), Shasta County (largely from copper-zinc ore), and Stanislaus County (almost entirely from connected-bucket gold dredging). Of the 28 counties producing, these 10 furnished over seven-eighths of the total value of the five metals produced in the State during the year.

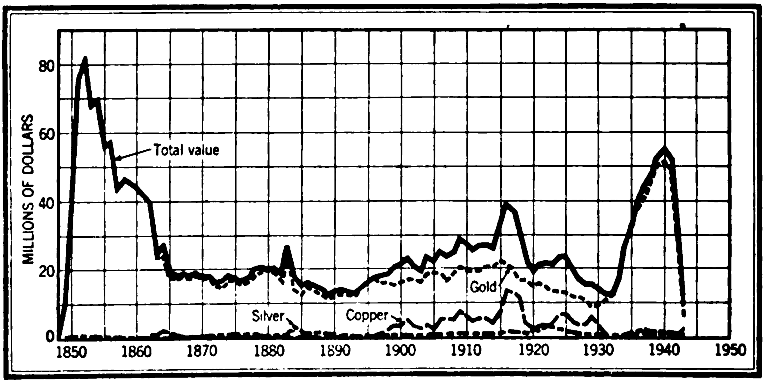

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in California, 1848–1943. The value of lead and zinc has exceeded $1,000,000 in only a few years.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942-43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in California, 1939–43, and total, 1848–1943, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	1,028	749	5,577,853	1,435,264	$50,234,240	2,599,139	$1,764,264
1940	1,030	836	4,669,433	1,455,671	50,948,485	2,359,776	1,678,063
1941	835	724	4,280,185	1,408,793	49,307,755	2,154,188	1,531,867
1942	434	428	2,503,198	847,997	29,679,895	1,450,440	1,031,424
1943	139	82	739,956	148,328	5,191,480	609,075	433,120
1848–1943	----------	----------	(2)	101,259,084	2,246,171,592	105,091,703	84,800,447

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	8,360,000	$869,440	1,052,000	$49,444	12,000	$624	$52,918,012
1940	12,876,000	1,454,988	3,544,000	177,200	158,000	9,954	54,268,690
1941	7,886,000	930,548	6,928,000	394,896	880,000	66,000	52,231,066
1942	2,116,000	256,036	10,302,000	690,234	1,226,000	114,018	31,771,607
1943	17,524,000	2,278,120	11,640,000	873,000	3,712,000	400,896	9,176,616
1848–1943	[3] 602,390	194,737,724	[3] 136,823	16,328,155	[3] 54,952	9,970,378	2,552,008,296

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] Figures not available.

[3] Short tons.

Gold produced at placer mines in California, 1939–43, by classes of mines and by methods of recovery, and total, 1848–1943 [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average per cubic yard
Surface placers:						
Gravel mechanically handled:						
Connected-bucket dredges:						
1939	34	47	121,655,000	370,264	$12,959,240	$0.107
1940	32	46	132,461,000	414,966	14,523,810	.110
1941	37	47	135,757,000	418,282	14,639,870	.108
1942	30	44	106,543,000	310,937	10,882,795	.102
1943	8	10	17,880,000	66,999	2,344,965	.131
Dragline dredges:						
1939	142	109	31,618,000	172,519	6,038,165	.191
1940	198	106	42,747,000	205,181	7,181,335	.168
1941	234	112	45,579,000	225,019	7,875,665	.173
1942	122	79	24,526,000	117,906	4,126,710	.168
1943	3	3	3,180,000	14,196	496,860	.156
Becker-Hopkins dredges:						
1940 [3]	2	2	35,000	148	5,180	.148
1941	3	2	52,000	244	8,540	.164
1942	1	----------	5,000	23	805	.161
1943	----------	----------	----------	----------	----------	----------
Suction dredges: [4]						
1940 [3]	4	4	64,000	584	20,440	.319
1941	17	17	357,000	1,763	61,705	.173
1942	18	15	278,000	1,419	49,665	179
1943	----------	----------	----------	----------	----------	----------
Nonfloating washing plants: [5]						
1939	114	101	5,512,000	41,694	1,459,290	.265
1940	131	105	5,908,000	28,232	988,120	.167
1941	85	76	5,656,000	28,703	1,004,605	.178
1942	46	40	1,637,000	10,044	351,540	.215
1943	16	15	547,000	2,997	104,895	.192

See footnotes at end of table.

Gold produced at placer mines in California, 1939–43, by classes of mines and by methods of recovery, and total, 1848–1943 [1]—Continued

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average per cubic yard
Surface placers—Continued.						
Gravel hydraulically handled:						
Hydraulic:						
1939	74	....	921,000	6,059	$212,065	$0.230
1940	92	....	2,401,000	12,059	422,065	.176
1941	79	....	2,886,000	10,145	355,075	.123
1942	45	....	1,980,000	6,106	213,710	.108
1943	12	....	366,000	1,723	60,305	.165
Small-scale hand methods: [6]						
Wet:						
1939	267	....	2,534,100	38,815	1,358,525	.536
1940	278	....	1,710,200	38,526	1,348,410	.788
1941	182	....	1,599,700	29,040	1,016,400	.635
1942	119	....	1,152,900	16,079	562,765	.488
1943	29	....	118,460	2,536	88,760	.749
Dry:						
1939	25	....	11,900	169	5,915	.497
1940	17	....	10,800	211	7,385	.684
1941	13	....	7,300	220	7,700	1.055
1942	7	....	1,100	73	2,555	2.323
1943	1	....	40	4	140	3.500
Underground placers:						
Drift:						
1939	94	....	83,000	6,525	228,375	2.752
1940	96	....	88,000	5,045	176,575	2.007
1941	74	....	90,000	4,597	160,895	1.788
1942	45	....	22,000	2,339	81,865	3.721
1943	13	....	4,500	970	33,950	7.544
Grand total placer:						
1939	[7] 749	....	162,335,000	636,045	22,261,575	.137
1940	[7] 836	....	185,425,000	704,952	24,673,320	.133
1941	724	....	191,984,000	718,013	25,130,455	.131
1942	[7] 428	....	136,145,000	464,926	16,272,410	.120
1943	82	....	22,096,000	89,425	3,129,875	.142
1848–1943 [1]	....	....	([8])	65,094,493	1,414,044,901	([8])

[1] For historic data by years see Minerals Yearbook, Review of 1940, p. 219.

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property worked.

[3] First year for which this method was reported used in California.

[4] Includes all placer operations using suction pump for delivering gravel to floating washing plant, except those producing less than 100 ounces of gold which are included under "Small-scale hand methods."

[5] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[6] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.

[7] A mine using more than 1 method of recovery is counted but once in arriving at total for all methods.

[8] Complete data not available.

Gold.—An uninterrupted rise beginning in 1929 culminated in the production of $50,948,485 in gold in 1940, the largest value since 1856. In 1941, however, a reaction set in which gained headway in 1942. By January 1943 monthly production had sunk to 16,425 ounces, and thereafter it fluctuated between that figure and a low of 8,547 ounces established in February. The year ended with an output of 9,824 ounces in December, second-lowest month of the year. Compared with 1942 the decrease of 699,669 ounces ($24,488,415) recorded in 1943 was greater in both quantity and value than that between any other 2 years in the State's history, not excluding 1852–53, 1854–55, and 1856–57, when flush placer output was failing; 1883–84, when the Sawyer Decision drastically reduced hydraulicking; and 1917–18, when World War I caused many operations to suspend or curtail output.

Mine production of gold in California, 1937–43, by months, in fine ounces, in terms of recovered metal

Month	1937	1938	1939	1940	1941	1942	1943
January	83,964	96,469	106,362	128,127	129,894	101,698	16,425
February	82,357	94,368	112,497	112,536	123,735	91,945	8,547
March	89,116	100,029	116,171	120,596	120,462	95,344	14,440
April	102,217	107,512	113,587	119,063	129,664	92,652	12,461
May	104,850	106,103	124,682	127,467	121,231	87,037	13,424
June	86,449	103,027	122,306	130,111	118,462	84,016	15,552
July	113,251	112,240	122,672	91,678	120,089	70,002	12,910
August	95,756	111,680	113,185	110,666	118,379	64,615	12,759
September	96,777	116,532	122,506	105,443	108,430	56,108	10,501
October	107,971	113,174	125,713	124,085	111,658	56,502	11,411
November	104,580	120,339	128,273	136,181	101,591	27,919	10,074
December	107,290	129,656	127,310	149,718	105,198	20,159	9,824
Total	1,174,578	1,311,129	1,435,264	1,455,671	1,408,793	847,997	148,328

A study of the monthly production figures since January 1937 brings out some points that are obscure in the annual figures. The uninterrupted upward trend shown in the annual figures beginning in 1929 and culminating in 1940 is paralleled in the available monthly data. It will be noted, however, that a serious recession was experienced in July 1940 from which the industry did not fully recover until November. This was caused by a labor strike at the Selby smelter and refinery of the American Smelting & Refining Co., which resulted in the postponement of many shipments of ore, concentrates, and bullion; the strike was called July 1, and work was resumed November 9. The peak reached in December 1940 may be attributed, at least in part, to the movement of material accumulated during the strike. Beginning with January 1941, however, the trend is unmistakably downward, and the rate of decline accelerates as the months pass. The downward plunge is arrested in October 1942 probably because many operations, closed by War Production Board Order L-208, made final clean-ups, which were shipped before the end of

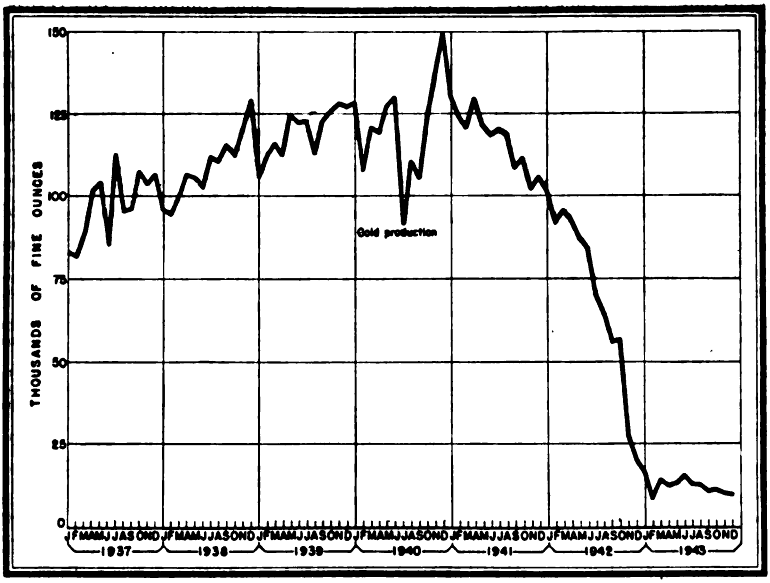

FIGURE 2.—Mine production of gold in California, 1937–43, by months, in terms of recovered gold.

the month. At any rate, the decline in November and December put the curve back on the precipitous trend line shown during the few months preceding October. By January production had reached a level that permitted but little further recession.

The 25 leading gold-producing mines in California in 1943, listed in the following table, yielded 92 percent of the total gold output of the State; the leading 5 mines produced 57 percent and the leading 10 mines 73 percent. Many changes have taken place in the list since 1942; only 9 of the mines listed in 1942 are on the 1943 list.

Twenty-five leading gold-producing mines in California in 1943, in order of output

Rank	Mine	District	County	Rank in 1942	Operator	Source of gold
1	Yuba Unit	Yuba River	Yuba	2	Yuba Consolidated Gold Fields.	Dredge.
2	Natomas Co.	Folsom	Sacramento	1	Natomas Co.	Do.
3	Lava Cap	Grass Valley-Nevada City.	Nevada	5	Lava Cap Gold Mining Corporation.	Gold ore.
4	Feather River channel.	Oroville	Butte	26	Golden Feather Dredging Co.	Dragline.
5	Eagle Shawmut	Mother Lode	Tuolumne	11	Miller & Clemson	Gold ore.
6	Empire Star mines.	Grass Valley-Nevada City.	Nevada	4	Empire Star Mines Co., Ltd., and New Verde Mines Corporation.	Do.
7	Tuolumne gold dredge.	La Grange	Stanislaus	37	Tuolumne Gold Dredging Corporation.	Dredge.
8	Upper Comanche dredge.	Camanche	San Joaquin	59	Gold Hill Dredging Co.	Do.
9	Original Sixteen to One.	Alleghany	Sierra	14	Original Sixteen to One Mine, Inc.	Gold ore.
10	Columbia No. 2	Resting Springs	Inyo	42	Shoshone Mines, Inc.	Lead ore.
11	Oroville dredge	Oroville	Butte	34	Oroville Gold Dredging Co.	Dredge.
12	Placer Properties	Knights Ferry	Stanislaus	15	Placer Properties Co.	Dragline.
13	Pine Tree and Josephine.	Mother Lode	Mariposa	28	Pacific Mining Co.	Gold ore.
14	Dakin (Gray Eagle).	Klamath River	Siskiyou	[1]	Gray Eagle Copper Co.	Copper ore.
15	Mount Gaines	Hunter Valley	Mariposa	23	Mount Gaines Mining Co.	Gold ore.
16	Plymouth Tailings.	Mother Lode	Amador	55	Argonaut Mining Co., Ltd.	Do.
17	Bagdad-Chase	Buckeye	San Bernardino.	31	Frank Royer	Do.
18	Quail Hill	West Belt	Calaveras	[1]	G. Ivan Smith	Zinc ore and zinc-copper ore.
19	Kutras tract	Redding	Shasta	65	Columbia Construction Co., Inc.	Nonfloat.
20	Cactus Queen	Mojave	Kern	9	Cactus Mines Co.	Gold ore.
21	Lower Comanche dredge.	Camanche	San Joaquin	38	Gold Hill Dredging Co.	Dredge.
22	Tungold	Randsburg	Kern	383	Rand Gold Dredging Associates.	Do.
23	Feliciana	Mother Lode	Mariposa	79	Russell Wilson	Gold ore.
24	Relief Hill	North Bloomfield	Nevada	119	Western Gold, Inc.	Hydraulic.
25	Red Hill	Junction City	Trinity	173	Goldfield Consolidated Mines Co.	Do.

[1] Not operated in 1942.

Silver.—Most of the silver output in California in 1943 was more localized than that of the gold; the 10 leading silver-producing mines listed in the following table yielded 89 percent of the State total recoverable silver in that year, and the 4 leading mines yielded 70 percent. All 10 leading mines derived their silver from ore other than straight silver, and most of them depended on argentiferous base-metal ores.

Copper.—Copper production in California in 1943 was the largest in both quantity and value since 1930. Most of the copper came from mines brought into production during the year. The following

Ten leading silver-producing mines in California in 1943, in order of output

Rank	Mine	District	County	Rank in 1942	Operator	Source of silver
1	Columbia No. 2	Resting Springs	Inyo	3	Shoshone Mines, Inc.	Lead ore.
2	Darwin group	Coso	do	6	Darwin Mines (Arthur J. Theis, trustee).	Do.
3	Lava Cap	Grass Valley-Nevada City.	Nevada	2	Lava Cap Gold Mining Corporation.	Gold ore.
4	Pine Creek	Bishop Creek	Inyo	5	United States Vanadium Corporation.	Tungsten-molybdenum ore.
5	Hornet	Flat Creek	Shasta	118	The Mountain Copper Co., Ltd.	Copper ore.
6	Last Chance	Coso	Inyo	(1)	L. D. Foreman	Lead ore.
7	Quail Hill	West Belt	Calaveras	(1)	G. Ivan Smith	Zinc ore and zinc-copper ore.
8	Gold Bottom	Slate Range	Inyo	(1)	Damon & Damon	Gold-silver ore and zinc ore.
9	Dakin (Gray Eagle).	Klamath River	Siskiyou	(1)	Gray Eagle Copper Co.	Copper ore.
10	Cactus Queen	Mojave	Kern	1	Cactus Mines Co.	Gold ore.

[1] Not operated in 1942.

seven companies, listed in order of copper production (each producing more than 100,000 pounds), supplied 98 percent of the State total and the first three 87 percent: Gray Eagle Copper Co. (Dakin mine, Klamath River district, Siskiyou County); Keystone Copper Co. (Keystone mine, Copperopolis district, Calaveras County); The Mountain Copper Co., Ltd. (Hornet mine, Flat Creek district, Shasta County); United States Vanadium Corporation (Pine Creek mine, Bishop Creek district, Inyo County); Winston Copper Co. (Newton mine, Ione district, Amador County); G. Ivan Smith (Quail Hill mine, West Belt district, Calaveras County); and Hoefling Bros. (Big Bend mine, Yankee Hill district, Butte County).

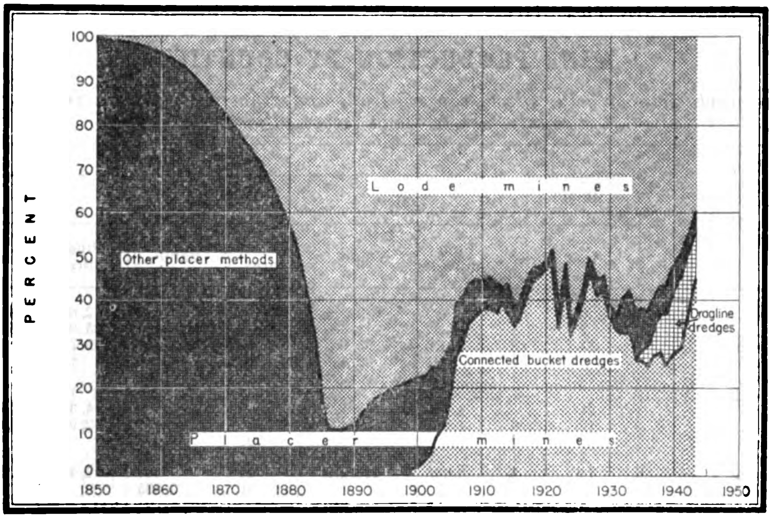

FIGURE 3.—Percentage of total California gold produced at lode and placer mines and by various methods of placer mining, 1850–1943.

Lead.—Lead production in California in 1943 was the largest in both quantity and value since 1918. The two leading producers accounted for well over three-fourths of the State output in 1943, as in 1942. The following seven companies, listed in order of lead production (each producing over 100,000 pounds), furnished 97 percent of the State total: Shoshone Mines, Inc. (Columbia No. 2 mine, Resting Springs district, Inyo County); Darwin Mines (Essex and Independence mines, Coso district, Inyo County); L. D. Foreman (Last Chance slag dump, Coso district, Inyo County); Damon & Damon (Gold Bottom mine, Slate Range district, Inyo County); L. D. Foreman (Lane Slag dump, Coso district, Inyo County); C. O. Mittendorf (Ophir mine, Slate Range district, Inyo County); and Southwest Lead & Zinc Co. (Honolulu-Big Horn mine, South Park district, Inyo County).

Zinc.—Zinc production in California in 1943 was the largest in both quantity and value since 1927. Most of the output came from mines brought into production during the year. The following eight companies, listed in order of zinc output (each producing over 100,000 pounds), contributed 99 percent of the State total: G. Ivan Smith (Quail Hill mine, West Belt district, Calaveras County); Hoefling Bros. (Big Ben mine, Yankee Hill district, Butte County); Darwin Mines (Essex and Independence mines, Coso district, Inyo County); The Mountain Copper Co., Ltd. (Hornet mine, Flat Creek district, Shasta County); E. A. Vogt (Collier mine, West Belt district, Calaveras County); E. H. Snyder (Colorado group, Modoc district, Inyo County); Southwest Lead & Zinc Co., (Honolulu-Big Horn mine, South Park district, Inyo County); and Damon & Damon (Gold Bottom mine, Slate Range district, Inyo County).

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in California in 1943, by counties, in terms of recovered metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	6	3	2,389	$83,615	217	$7,595	2,606	$91,210
Butte	2	5	332	11,620	14,672	513,520	15,004	525,140
Calaveras	11	3	2,676	93,660	80	2,800	2,756	96,460
Eldorado	6	1	71	2,485	73	2,555	144	5,040
Fresno		1			36	1,260	36	1,260
Humboldt		1			199	6,965	199	6,965
Inyo	21		4,375	153,125			4,375	153,125
Kern	12	6	1,957	68,495	1,006	35,210	2,963	103,705
Los Angeles		2			97	3,395	97	3,395
Madera	3	1	9	315	1	35	10	350
Mariposa	14	2	6,465	226,275	24	840	6,489	227,115
Merced		1			81	2,835	81	2,835
Mono	4		8	280			8	280
Nevada	8	3	20,464	716,240	1,019	35,665	21,483	751,905
Orange	1							
Placer	7	9	480	17,115	771	26,985	1,260	44,100
Plumas	5	2	119	4,165	95	3,325	214	7,490
Sacramento		4			16,156	565,460	16,156	565,460
San Bernardino	14	2	2,138	74,830	214	7,490	2,352	82,320
San Joaquin		3			5,070	177,450	5,070	177,450
Shasta	5	3	410	14,350	1,752	61,320	2,162	75,670
Sierra	5	6	3,915	137,025	754	26,390	4,669	163,415
Siskiyou	4	10	2,750	96,250	394	13,790	3,144	110,040
Stanislaus		3			7,476	261,660	7,476	261,660
Trinity	1	6	17	595	872	30,520	889	31,115
Tulare	1							
Tuolumne	9	(2)	10,319	361,165	80	2,800	10,399	363,965
Yuba		5			38,286	1,340,010	38,286	1,340,010
	139	82	58,903	2,061,605	89,425	3,129,875	148,328	5,191,480
Total, 1942	434	428	383,071	13,407,485	464,926	16,272,410	847,997	29,679,895

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1943, by counties, in terms of recovered metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	2,215	$1,575	45	$32	2,260	$1,607
Butte	5,691	4,047	1,485	1,056	7,176	5,103
Calaveras	37,696	26,806	7	5	37,703	26,811
Eldorado	419	298	7	5	426	303
Fresno			4	3	4	3
Humboldt			28	20	28	20
Inyo	384,899	273,706			384,899	273,706
Kern	10,052	7,148	187	133	10,239	7,281
Los Angeles			17	12	17	12
Madera	128	91			128	91
Mariposa	1,724	1,226	7	5	1,731	1,231
Merced			28	20	28	20
Mono	599	426			599	426
Nevada	103,375	73,511	76	54	103,451	73,565
Orange	415	295			415	295
Placer	408	290	104	74	512	364
Plumas	592	421	10	7	602	428
Sacramento			810	576	810	576
San Bernardino	8,865	6,304	45	32	8,910	6,336
San Joaquin			512	364	512	364
Shasta	31,770	22,592	187	133	31,957	22,725
Sierra	758	539	62	44	820	583
Siskiyou	9,384	6,673	55	39	9,439	6,712
Stanislaus			516	367	516	367
Trinity	14	10	76	54	90	64
Tulare	486	346			486	346
Tuolumne	3,593	2,555	7	5	3,600	2,560
Yuba			1,717	1,221	1,717	1,221
	603,083	428,859	5,992	4,261	609,075	433,120
Total, 1942	1,409,805	1,002,528	40,635	28,896	1,450,440	1,031,424

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador	624,000	$81,120	2,000	$150			$174,087
Butte	128,000	16,640	16,000	1,200	814,000	$87,912	635,995
Calaveras	4,172,000	542,360	98,000	7,350	1,366,000	147,528	820,509
Eldorado	20,000	2,600					7,943
Fresno							1,263
Humboldt							6,985
Inyo	964,000	125,320	11,418,000	856,350	1,050,000	113,400	1,521,901
Kern	2,000	260			16,000	1,728	112,974
Los Angeles							3,407
Madera	22,000	2,860					3,301
Mariposa							228,346
Merced							2,855
Mono	10,000	1,300	4,000	300			2,306
Nevada	4,000	520	18,000	1,350			827,340
Orange							295
Placer	4,000	520					44,984
Plumas	14,000	1,820	4,000	300			10,038
Sacramento							566,036
San Bernardino	80,000	10,400	66,000	4,950	8,000	864	104,870
San Joaquin							177,814
Shasta	1,340,000	174,200	8,000	600	458,000	49,464	322,659
Sierra							163,998
Siskiyou	10,134,000	1,317,420					1,434,172
Stanislaus							262,027
Trinity							31,179
Tulare			6,000	450			796
Tuolumne	6,000	780					367,305
Yuba							1,341,231
	17,524,000	2,278,120	11,640,000	873,000	3,712,000	400,896	9,176,616
Total, 1942	2,116,000	256,036	10,302,000	690,234	1,226,000	114,018	31,771,607

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[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] Output from property not classed as a "mine."

MINING INDUSTRY

The tonnage of material from lode mines in California treated in 1943 decreased 65 percent compared with 1942, and the yardage at placer mines decreased 84 percent; the output of lode gold declined 85 percent and that of placer gold 81 percent. The increased production of base-metal ore accounts for the smaller decline in ore tonnage than in lode-gold production. The average recoverable gold content of gravels increased 18 percent. Of the State total gold output in 1943, 40 percent came from lode mines and 60 percent from placers; this represents the highest placer : lode ratio since 1900, when separate annual data were first compiled, and almost certainly the highest since large-scale hydraulicking was terminated by the Sawyer Decision of 1884.

Dredges of the connected-bucket type washed about 80 percent of the total gravel mined in 1943 in the State and recovered 75 percent of the total placer gold; the value of gold produced by connected-bucket dredges was the smallest since 1904 and its quantity the smallest since 1902. Dragline dredges washed 14 percent of the gravel mined and recovered 16 percent of the placer gold, the lowest point reached by dragline dredging in either yardage washed or gold recovered since 1934—the second year in which the method was used in California. Of the three dragline dredges active in 1943 one had two dragline excavators with 2½- and 6-cubic yard buckets, respectively; one had a dragline excavator with a 5-cubic yard bucket; and one was an experimental one-man outfit which used a gasoline-driven excavator with a ½-cubic yard bucket.

All other placer-mining methods also showed decreases in both quantity of gravel washed and gold recovered. No Becker-Hopkins or suction dredges were reported in production during 1943. Nonfloating washing plants to which gravel was delivered by mechanical means (dragline excavators, power shovels, slackline excavators, trucks, bulldozers) treated much less gravel than in 1942. Many of these operators found that their equipment could be employed more profitably on war contracts; competition for labor skilled in operating earth-moving machines was very keen.

Hydraulic mining at established mines found itself singularly free from shortages of materials and power, but labor conditions caused marked reductions in operations. Very few hydraulic mines reopened for the 1943–44 season. Gold production from small-scale hand methods was sharply curtailed. In normal times a large number of such operations are carried on independently by marginal workers, but the increasing labor shortage in California in 1943 caused many small-scale hand miners to abandon the streams and dry diggings for employment at wages. Drift mining, once very productive in California, also declined owing to war conditions. The average grade of gravel washed at drift mines was the highest recorded in the 23 years that such data have been compiled. This high figure of $7.54 per cubic yard probably represents the average grade of material that can be washed profitably, whereas the lower figures of earlier years include much unprofitable gravel washed during exploratory campaigns.

Consumption of quicksilver at California placer mines totaled 2,026 pounds in 1943 compared with 13,944 pounds in 1942. The following quantities of gold were recovered to the pound of quicksilver used in 1943 (1942 figures in parentheses): Connected-bucket dredging, 40 ounces (34); dragline dredging, 49 ounces (40); nonfloating washing plants with mechanical gravel handling, 49 ounces (17); hydraulicking, 11 ounces (16); and small-scale hand operation, 23 ounces (18).

ORE CLASSIFICATION

Of the 739,956 tons of ore (including 158,770 tons of old tailings) sold or treated in 1943, 55 percent was dry gold, 36 percent copper, 7 percent lead, 1 percent zinc, and the remainder zinc-copper, dry gold-silver, zinc-lead, and dry silver. Substantial quantities of copper and silver and some gold and lead were recovered from ore valued chiefly for tungsten and molybdenum; this ore is not included in tonnage figures, but the metals are included in the metal totals.

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in California in 1943, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	254, 179	155, 333	49, 760	129, 856	79, 200	24, 800	....
Dry and siliceous gold-silver ore	2, 850	....	380	11, 380	15, 500	196, 800	....
Dry silver ore	246	185	....	1, 890	5, 900	18, 600	....
	257, 275	155, 518	50, 140	143, 126	100, 600	240, 200	....
Copper ore	262, 326	3, 200	2, 971	47, 214	[1] 16, 030, 600	10, 000	458, 000
Lead ore	48, 986	52	3, 411	296, 829	59, 800	11, 026, 400	536, 700
Zinc ore	8, 428	....	450	16, 546	180, 700	123, 700	1, 621, 500
Zinc-copper ore	[2] 3, 435	....	[3] 1, 920	[3] 96, 187	[3] 1, 146, 400	[3] 75, 200	902, 600
Zinc-lead ore	736	....	11	3, 181	5, 900	164, 500	193, 200
Total, lode mines	[2] 581, 186	158, 770	[3] 58, 903	[3] 603, 083	[1, 3] 17, 524, 000	[3] 11,640, 000	3, 712, 000
Total, placers	....	....	89, 425	5, 992	....	....	....
	[2] 581, 186	158, 770	[3] 148,328	[3] 609, 075	[1, 3] 17, 524. 000	[3] 11,640, 000	3, 712, 000
Total, 1942	[4] 1, 877, 634	625, 564	[3] 847, 997	[3] 1, 450, 440	[3, 5] 2, 116, 000	[3] 10,302, 000	1, 226, 000

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[1] Includes 65,000 pounds from precipitates.
[2] Excludes tungsten ore.
[3] Includes metal recovered from tungsten ore.
[4] Includes ore valued principally for tungsten and molybdenum.
[5] Includes 71,100 pounds from precipitates.

METALLURGIC INDUSTRY

During 1943, 54 percent of the total ore and old tailings handled was treated at amalgamation and cyanidation mills (with or without concentrating equipment); most of the remainder was treated at concentrating mills; and only 65,608 tons of crude ore and old tailings were shipped for direct smelting. Smelters also received 52,495 tons of flotation concentrates and 219 tons of gravity concentrates from California mine operators. Comparing 1943 with 1942, material treated at cyanidation mills decreased 80 percent, and the quantity of crude ore and old tailings smelted increased 9 percent; the quantities of ore concentrated in 1942 and 1943 are not comparable because a substantial tonnage of tungsten ore was included in 1942 but excluded in 1943. The quantity of ore (other than tungsten ore) concentrated in 1943 was five times that in 1942.

Because of the unusual conditions in the California gold industry in 1943, quicksilver- and cyanide-consumption data at mills were not representative of the industry. Only 50 pounds of quicksilver and 21,800 pounds of 91-percent sodium cyanide were reported consumed at amalgamation and cyanidation mills.

The Selby lead smelter of the American Smelting & Refining Co. was the only custom plant that treated gold, silver, copper, lead, or zinc ores in California in 1943. Some ore and concentrates were shipped to out-of-State smelters. Most of the ore produced in the State, however, was treated in company-owned metallurgical plants at the mines. Mills put into production during 1943 included: A 700-ton flotation mill built by the Gray Eagle Copper Co., at the Dakin mine, Klamath River district, Siskiyou County; a 300-ton flotation mill built by The Mountain Copper Co., Ltd., at the Hornet mine, Flat Creek district, Shasta County; and a 1,200-ton flotation plant built by the Pacific Mining Co. at the Union old tailings pond, Copperopolis district, Calaveras County. During the year Hoefling Bros. converted the Surcease gold mill, Yankee Hill district, Butte County, to a flotation mill to treat zinc ore from the Big Bend mine; Red Cloud Mines, Inc., converted the Mount Gaines gold mill, Hunter Valley district, Mariposa County, to a flotation mill to treat zinc ore from the Blue Moon mine; and Eagle Shawmut Mine set up a flotation circuit in the Eagle Shawmut gold mill, Mother Lode district, Tuolumne County, to treat copper-zinc ore from the Penn mine, Campo Seco district, Calaveras County.

Mine production of metals in California in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	199,088	12,145	3,956			
Ore and old tailings cyanided	202,429	8,039	16,390			
Concentrates smelted:						
Flotation	52,495	29,490	245,875	16,283,500	697,910	2,307,300
Gravity	219	874	405	200		
Ore and old tailings smelted	65,608	8,356	336,457	1,175,300	10,942,090	1,404,700
Precipitates				65,000		
Total, lode mines		58,903	603,083	17,524,000	11,640,000	3,712,000
Total, placers		89,425	5,992			
		148,328	609,075	17,524,000	11,640,000	3,712,000
Total, 1942		847,997	1,450,440	2,116,000	10,302,000	1,226,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in California in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal				
	Ore[1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	10		37	7					
Calaveras	1,334		150	61	140	397	70		200
Eldorado	27		33	9					
Inyo	20	150	61	5					
Kern	152		59	35					
Madera	30		1						
Mariposa	31,935	35	2,695	692	625	3,742	1,011		
Nevada	5,380		4,721	2,268	2	35	77		
Placer	440		365	128	57	113	149	200	
Plumas	131		24	4					
Shasta	10		9						
Sierra	3,084		3,342	588	108	573	170		
Siskiyou	742		264	52					
Tuolumne	155,608		384	107	3,392	9,921	3,455	6,000	
	198,903	185	12,145	3,956	4,324	14,781	4,932	6,200	200
Total, 1942	777,287	8,658	144,004	29,010	10,445	39,731	41,839	16,500	48,100

CYANIDATION MILLS

Amador		149,900	981	319	464	1,328	394	500	
Butte	9		146	394					
Inyo	3		96	51					
Kern	85	4,675	1,281	5,262	14	604	4,599	200	
Mariposa		506	28	21					
Nevada	47,250		5,485	10,337	1,739	10,206	90,631	4,000	17,800
San Bernardino	1		22	6					
	47,348	155,081	8,039	16,390	2,217	12,138	95,624	4,700	17,800
Total, 1942	568,955	437,406	133,710	395,350	5,150	45,158	530,780	14,900	15,200
Grand total:									
1943	246,251	155,266	20,184	20,346	6,541	26,919	100,556	10,900	18,000
1942	1,346,242	446,064	277,714	424,360	15,595	84,889	572,619	31,400	63,300

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[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.

Mine production of metals from concentrating mills in California in 1943, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Butte	3,940		978	186	5,297	128,000	16,000	814,000
Calaveras	74,081	3,200	9,725	319	12,959	3,907,700	24,400	463,400
Eldorado	300		61	26	351	19,800		
Inyo	4,450		[1] 3,492	[1] 166	[1] 87,504	[1] 888,000	631,510	566,400
Kern	33		6		64			5,500
Shasta	41,662		5,245	262	30,217	1,195,300	8,000	458,000
Siskiyou	145,165		26,668	2,486	9,332	10,134,000		
	269,631	3,200	[1] 46,173	[1] 3,445	[1] 145,724	[1] 16,272,800	679,910	2,307,300
Total, 1942	[2] 435,332		6,007	7,097	86,796	1,252,900	650,100	547,000

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[1] Includes concentrates and metals from tungsten ore not included in material treated.
[2] Includes ore valued principally for tungsten and molybdenum.

Gross metal content of concentrates produced from ores mined in California in 1943, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	6,819	27,012	100,947	21,102	26,634	20,141
Copper	41,921	2,947	112,415	16,575,552	8,809	
Lead	1,265	57	16,458	5,538	610,348	125,864
Zinc	1,537	46	6,428	33,675	72,731	1,592,347
Zinc-copper	1,172	302	10,032	185,090	22,898	1,016,239
	52,714	30,364	246,280	16,820,957	741,420	2,754,591
Total, 1942	21,602	91,986	659,415	1,340,945	755,575	661,592

Mine production of metals from California concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	464	1,328	394	500		
Butte	978	186	5,297	128,000	16,000	814,000
Calaveras	9,865	716	13,029	3,907,700	24,600	463,400
Eldorado	61	26	351	19,800		
Inyo	3,492	166	87,504	888,000	631,510	566,400
Kern	20	604	4,663	200		5,500
Mariposa	625	3,742	1,011			
Nevada	1,741	10,241	90,708	4,000	17,800	
Placer	57	113	149	200		
Shasta	5,245	262	30,217	1,195,300	8,000	458,000
Sierra	108	573	170			
Siskiyou	26,666	2,486	9,332	10,134,000		
Tuolumne	3,392	9,921	3,455	6,000		
	52,714	30,364	246,280	16,283,700	697,910	2,307,300
Total, 1942	21,602	91,986	659,415	1,284,300	713,400	547,000

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	6,819	27,012	100,947	13,000	23,000	
Copper	41,921	2,947	112,415	16,067,300	5,800	
Lead	1,265	57	16,458	3,700	580,900	
Zinc	1,537	46	6,428	32,000	66,410	1,431,100
Zinc-copper	1,172	302	10,032	167,700	21,800	876,200
	52,714	30,364	246,280	16,283,700	697,910	2,307,300

Gross metal content of California crude ore and old tailings shipped to smelters in 1943, by classes of material

Class of ore	Material shipped		Gross metal content				
	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	7,918	67	2,649	8,947	73,742	7,397	
Dry gold-silver	2,850		380	11,380	25,222	204,318	
Dry silver	246	185		1,890	6,966	24,332	
Copper	4,205		124	3,912	[1] 841,160	2,384	
Lead	44,640	52	3,357	281,102	87,339	10,938,496	3,105,820
Zinc	1,274		26	1,450	8,352	82,882	461,161
Zinc-copper	3,435		1,808	24,595	310,900	74,505	1,454,889
Zinc-lead	736		11	3,181	6,849	174,214	302,430
	65,304	304	8,355	336,457	[1] 1,360,530	11,508,528	5,324,300
Total, 1942	60,395		13,371	326,030	[2] 872,831	10,044,352	3,702,336

[1] Includes 65,096 pounds contained in precipitates. [2] Includes 71,445 pounds contained in precipitates.

Mine production of metals from California crude ore and old tailings shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Material shipped		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	3,596	...	43	1,495	623,500	2,000	...
Calaveras	3,436	...	1,810	24,606	264,300	73,400	902,600
Eldorado	19	...	12	59	200	...	...
Inyo	49,421	237	4,052	297,339	76,000	10,786,490	483,600
Kern	75	...	13	92	1,800	...	10,500
Madera	36	...	8	128	[1] 22,000	...	...
Mono	94	...	8	599	10,000	4,000	...
Nevada	32	...	17	62	...	200	...
Orange	42	...	...	415	...	...	...
Placer	98	...	11	131	3,800	...	...
Plumas	37	67	95	588	14,000	4,000	...
San Bernardino	7,851	...	2,116	8,859	80,000	66,000	8,000
Shasta	550	...	139	1,553	[2] 144,700	...	...
Trinity	7	...	17	14	...	...	...
Tulare	6	...	...	486	...	6,000	...
Tuolumne	4	...	14	31	...	...	...
	65,304	304	8,355	336,457	[3] 1,240,300	10,942,090	1,404,700
Total, 1942	60,395	...	13,371	326,030	[4] 831,700	9,588,600	679,000

BY CLASSES OF MATERIAL

	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
Dry gold	7,918	67	2,649	8,947	68,300	6,800	...
Dry gold-silver	2,850	...	380	11,380	15,500	196,800	...
Dry silver	246	185	...	1,890	5,900	18,600	...
Copper	4,205	...	124	3,912	[3] 821,000	2,000	...
Lead	44,640	52	3,357	281,102	53,900	10,401,200	...
Zinc	1,274	...	26	1,450	5,500	78,790	308,900
Zinc-copper	3,435	...	1,808	24,595	264,300	73,400	902,600
Zinc-lead	736	...	11	3,181	5,900	164,500	193,200
	65,304	304	8,355	336,457	[3] 1,240,300	10,942,090	1,404,700

[1] Includes 11,700 pounds from precipitates.
[2] Includes 53,300 pounds from precipitates.
[3] Includes 65,000 pounds from precipitates.
[4] Includes 71,100 pounds from precipitates.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in California in 1943, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
Amador County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Camanche [4]		1			1	1					$35
East Belt [5]		2			29	29	4				1, 018
Ione	1		3, 538	24		24	1, 481	623, 500	2, 000		83, 098
Mother Lode [6]	5	(7)	149, 968	2, 365	187	2, 552	775	500			89, 936
Butte County:											
Butte Creek		1			112	112	21				3, 935
Enterprise		1			10	10					350
Forbestown		(7)			17	17	4				598
Oroville		3			14, 533	14, 533	1, 460				509, 693
Yankee Hill	2		3, 949	332		332	5. 691	128, 000	16, 000	814, 000	121, 419
Calaveras County:											
Copperopolis	3		74, 205	83		83	3, 420	3, 860, 500			507, 202
East Belt [5]	3		45	18		18	3				632
Jenny Lind	2	1	339	122	36	158	100				5, 601
Mother Lode [6]	1	2	950	407	44	451	35		200		15, 825
Eldorado County:											
East Belt [5]	1	1	26	16	21	37	7				1, 300
Mother Lode [6]	2	(7)	6	27	29	56	7				1, 965
West Belt [8]	3	(7)	314	28	23	51	412	20, 000			4, 678
Fresno County: Friant		1			36	36	4				1, 263
Humboldt County:											
Gold Bluff		1			186	186	24				6, 527
Orleans		(7)			13	13	4				458
Inyo County:											
Cerro Gordo	2		286	6		6	1, 551	900	29, 600		3, 650
Coso	4		25, 825	251		251	138, 662	53, 500	4. 895, 800	536, 700	539, 493
Fish Springs	1		120	7		7	1, 194	400	27, 200	15, 200	4, 828
Modoc	2		640	2		2	824	200	49, 800	207, 300	26, 805
Resting Springs	2		22, 547	3, 146		3, 146	153, 540	5, 000	5, 875, 600		660, 614
Sherman	1		2	39		39	3				1, 367
Slate Range	2		3, 817	406		406	13, 909	21, 000	383, 200	120, 800	68, 617
South Park	3		746	66		66	2, 132	800	123, 200	170, 000	31, 530
Ubehebe	1		36	1		1	596		29, 200		2, 649
Union	1		261	282		282	848	100	2, 600		10, 681
Wild Rose	1		1	57		57	48				2, 029
Kern County:											
China Grade		1			163	163	28				5, 725
Gorman	1		58				114			16, 000	1, 809
Havilah	1		21	4		4	3				142

Mojave	3		85	1,544		1,544	9,658	200			60,934
Pioneer	1		6				4				3
Rademacher	2		43	11		11	38	1,800			646
Randsburg [9]	3	5	4,677	344	843	1,187	363				41,803
Los Angeles County: San Gabriel		2			97	97	17				3,407
Madera County:											
Daulton	2		36	8		8	128	[10] 22,000			3,231
North Fork	1		30	1		1					35
Potter Ridge		1			1	1					35
Mariposa County:											
East Belt [5]	7		862	970		970	208				34,098
Hunter Valley	3	(7)	2,803	2,400	8	2,408	771				84,828
Mother Lode [6]	4	2	28,811	3,095	16	3,111	752				109,420
Merced County: Snelling		1			81	81	28				2,855
Mono County:											
Blind Springs	1		1	3		3	149				211
Homer	1		84	1		1	235	10,000			1,502
Masonic	1		1	4		4	4				143
West Walker River	1		8				211		4,000		450
Nevada County:											
French Corral		(7)			4	4					140
Grass Valley	7	(7)	52,630	20,447	158	20,605	103,334	4,000	17,800		796,512
Washington	1	1	32	17	75	92	65		200		3,281
You Bet		1			109	109	14				3,825
Orange County: Lake Elsinore	1		42				415				295
Placer County:											
Auburn		(7)			221	221	41				7,764
Butcher Ranch		1			19	19	4				668
Dutch Flat	2	2	45	4	48	52	73	2,000			2,132
Foresthill	1	2	4	1	105	106	13				3,719
Iowa Hill		1			145	145	20				5,089
Last Chance		2			140	140	11				4,908
Lincoln	2		63	9		9	62	1,800			593
Michigan Bluff		1			58	58	7				2,035
Ophir	2	(7)	426	475	35	510	281	200			18,076
Plumas County:											
Genesee	2		37	38		38	533	14,000			3,529
Greenville	1		6	1		1					35
Johnsville	2	1	192	80	23	103	62		4,000		3,949
La Porte		(7)			45	45	3				1,577
Quincy		(7)			8	8					280
Rich Bar		(7)			15	15	4				528
Seneca		1			4	4					140
Sacramento County:											
Cosumnes River		(7)			91	91	7				3,190
Folsom		4			16,065	16,065	803				562,846
San Bernardino County:											
Bellville	2		462	63		63	128	17,400			4,558
Buckeye	1		6,652	2,025		2,025	5,622	47,800			81,087
Clark Mountain	1		233	2		2	499	800	41,400		3,634
Holcomb Valley		1			4	4					140

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1943, by counties and districts, in terms of recovered metals [1]—Continued

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
San Bernardino County—Continued.			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
New York Mountains	1		68	2		2	117	4,700	22,000	8,000	$3,278
Old Woman Mountains	1		1				90				64
Randsburg [9]	2	1	179	31	210	241	1,862				9,759
Silver Mountain	1		43				381		2,600		466
Whipple Mountains	5		214	15		15	211	9,300			1,884
San Joaquin County: Camanche [4]		3			5,070	5,070	512				177,814
Shasta County:											
Flat Creek	1		42,056	291		291	31,642	[11] 1,339,500	8,000	458,000	256,885
French Gulch	1	(7)	73	17	1	18	17				642
Igo		(7)			189	189	21				6,630
Old Diggings	1		73	85		85	104	500			3,114
Redding		1			1,555	1,555	166				54,543
Shasta	2		20	17		17	7				600
Slate Creek		2			7	7					245
Sierra County:											
Alleghany	(12)	(7)	(12)	(12)	92	[13] 92	[13] 17				[13] 3,232
Brandy City		(7)			2	2					70
Depot Hill		1			90	90	10				3,157
Downieville	(12)	3	(12)	(12)	387	[13] 387	[13] 21				[13] 13,560
Pike	2		515	115		115	24				4,042
Poker Flat		2			183	183	14				6,415
Siskiyou County:											
Callahan		3			19	19	3				667
Deadwood		(7)			21	21	3				737
Greenhorn		(7)			11	11	4				388
Klamath River	1	1	145,165	2,486	143	2,629	9,353	10,134,000			1,416,086
Liberty	2	4	112	85	186	271	38				9,512
Quartz Valley		(7)			3	3					105
Salmon River		1			10	10					350
Scott Bar	1	1	630	179	1	180	38				6,327
Stanislaus County:											
Knights Ferry		2			3,031	3,031	263				106,272
La Grange		1			4,445	4,445	253				155,755
Trinity County:											
Big Bar		1			21	21	3				737
Coffee Creek		(7)			32	32	3				1,122
Crow Creek		1			9	9					315
Helena		(7)			13	13					455
Junction City		2			548	548	49				19,215
Lewiston		(7)			27	27	4				948

Salyer	----------	1	----------	----------	12	12	----------	----------	----------	----------	420
Weaverville	1	1	7	17	210	227	31	----------	----------	----------	7,967
Tulare County: Camp Nelson	1	----------	6	----------	----------	----------	486	----------	6,000	----------	796
Tuolumne County:											
East Belt [5]	7	(7)	97	110	39	149	56	----------	----------	----------	5,255
Mother Lode [6]	2	(7)	155,515	10,209	41	10,250	3,544	6,000	----------	----------	362,050
Yuba County:											
Camptonville	----------	2	----------	----------	9	9	----------	----------	----------	----------	315
Challenge	----------	1	----------	----------	49	49	3	----------	----------	----------	1,717
Dobbins	----------	(7)	----------	----------	3	3	----------	----------	----------	----------	105
Other districts [14]	7	3	[15] 9,211	[16] 6,012	38,898	[16] 44,910	[16] 108,254	[16] 1,193,600	[16] 99,600	1,366,000	[16] 1,958,997
Total California	139	82	[15] 739,956	[16] 58,903	89,425	[16] 148,328	[16] 609,075	[16] [17] 17,524,000	[16] 11,640,000	3,712,000	[16] 9,176,616

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[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 14 and their output included under "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 603,083 ounces from lode mines and 5,992 ounces from placers.

[4] Camanche district lies in Amador and San Joaquin Counties.

[5] East Belt district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.

[6] Mother Lode district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.

[7] Output from property not classed as a "mine."

[8] West Belt district lies in Calaveras and Eldorado Counties.

[9] Randsburg district lies in Kern and San Bernardino Counties.

[10] Includes 11,700 pounds from precipitates.

[11] Includes 53,300 pounds from precipitates.

[12] Included under "Other districts."

[13] Exclusive of lode output, which is included under "Other districts."

[14] Includes following: West Belt district in Calaveras County; Bishop Creek in Inyo County; Green Mountain in Kern County; North Bloomfield in Nevada County; Alleghany (lode) and Downieville (lode) in Sierra County; Smartville and Yuba River in Yuba County.

[15] Excludes tungsten ore.

[16] Includes metal recovered from tungsten ore.

[17] Includes 65,000 pounds from precipitates.

AMADOR COUNTY

Ione district.—The Newton mine was reopened and developed by J. H. Lester from January 1 until July 2, 1943; work was resumed by the Winston Copper Co. on July 24 and continued until the end of the year. The latter company shipped 3,538 tons of copper ore containing 24 ounces of gold, 1,481 ounces of silver, 639,800 pounds of copper, and 2,339 pounds of lead to a smelter. The ore was removed from points above the 100-foot level, but preparations were made for deeper mining. Diamond drilling carried on by the Bureau of Mines indicated a substantial reserve of copper ore above the 500-foot level.

Mother Lode district.—The Argonaut Mining Co., Ltd., operated a 500-ton flotation and cyanide plant for treatment of old tailings at the Plymouth mine from January 1 to November 30, 1943, when production was suspended in compliance with War Production Board Order L-208.

BUTTE COUNTY

Oroville district.—The Golden Feather Dredging Co. operated a dragline dredge on the Feather River channel at Oroville throughout 1943; an electric dragline excavator equipped with a 5-cubic yard bucket was used. This operation was given a special permit by the War Production Board because gravel was cleared from the Feather River channel and stacked as a levee to protect the town of Oroville. The Morris Ravine Mining Co. operated a drift mine in Morris Ravine throughout the year; an extremely high grade of gravel was produced. The Oroville Gold Dredging Co. operated a connected-bucket dredge equipped with 72 8½-cubic foot buckets on the Feather River 9 miles southwest of Oroville from May 22 to December 31.

Yankee Hill district.—When War Production Board Order L-208 went into effect Hoefling Bros. suspended operations at the Surcease gold mine and shifted attention to the Big Bend mine—a nearby prospect. Development at the Big Bend reached a point in May 1943 where production could be begun, and ore was shipped for concentration at the Surcease mill which had been converted to treat the new type of ore. By the end of the year 3,940 tons of zinc ore had been milled, and 978 tons of concentrates (containing 186 ounces of gold, 5,297 ounces of silver, 138,381 pounds of copper, 16,705 pounds of lead, and 918,586 pounds of zinc) had been produced and shipped. This property was the second-largest zinc producer in the State in 1943. A mill clean-up during the conversion resulted in the recovery of 146 ounces of gold and 394 ounces of silver, which were credited to the Surcease mine.

CALAVERAS COUNTY

Copperopolis district.—The Keystone mine was operated by the Keystone Copper Co. through the North Keystone shaft from January 1 to June 30, when a reorganization was effected which brought in the managerial services of the Lava Cap Gold Mining Corporation organization of Grass Valley, and production continued under the Keystone Copper Corporation. During the year 71,004 tons of copper ore were treated at the nearby redesigned Mountain King flotation mill, and 8,794 tons of copper concentrates containing 81 ounces of gold, 3,409 ounces of silver, and 3,978,872 pounds of copper were shipped. This company was the second-largest copper producer in the State in 1943. The Pacific Mining Co. constructed a flotation plant for treating old tailings at the Union mine. The tailings pile (estimated to contain 600,000 tons) was to be treated at the rate of 1,200 tons daily for a total recovery of 5,000,000 pounds of copper in concentrates carrying 15 percent copper. Production was begun a few days before the end of the year.

Jenny Lind district.—Frank S. Tower operated the Royal mine during 1943; 300 tons of ore yielded amalgamation bullion containing 84 ounces of gold and 50 ounces of silver and 7 tons of flotation concentrates containing 26 ounces of gold and 40 ounces of silver.

West Belt district.—Ernest A. Vogt operated the Collier mine during 1943 and shipped 2,903 tons of zinc ore for treatment by concentration and smelting. The ore contained 274 ounces of gold, 10,277 ounces of silver, 50,231 pounds of copper, 30,582 pounds of lead, and 612,479 pounds of zinc. The mine shaft was sunk to 175 feet, and 464 feet of drifts were driven. G. Ivan Smith operated the Quail Hill mine during the year and shipped zinc-copper ore to a smelter and zinc ore to a concentrator.

FRESNO COUNTY

Friant district.—The Grant Service Rock Co., Consolidated, recovered 36 ounces of gold and 4 ounces of silver in preparing 210,000 tons of sand and gravel for concrete aggregate.

HUMBOLDT COUNTY

Gold Bluff district.—Orick Placers, Inc., operated a washing plant to recover gold from beach sand during 1943.

INYO COUNTY

Bishop Creek district.—The United States Vanadium Corporation produced by flotation a copper concentrate containing a substantial quantity of silver per ton as a byproduct from ore treated primarily for tungsten.

Cerro Gordo district.—L. D. Foreman shipped old tailings from the Cerro Gordo mine to a smelter. Imperial Metals, Inc., and the Golden Queen Mining Co. carried on a joint exploration campaign, reopening the old workings of the Cerro Gordo mine; no ore was shipped. Desert Miners shipped lead ore from the Leary mine in the Swansea section of the Cerro Gordo district during 1943.

Coso district.—The Darwin group of mines—which includes the Defiance, Independence, Essex, Thompson, Lucky Jim, Lane, Promontory, and Columbia claims—was operated by Imperial Metals, Inc., from January 1 to February 28, 1943, when it was reorganized as Darwin Mines (Arthur J. Theis, trustee); this company continued the operation until the end of the year. Of the 15,925 tons of lead ore shipped, 11,579 tons (containing 191 ounces of gold, 87,373 ounces of silver, 20,701 pounds of copper, and 3,036,053 pounds of lead) were smelted; 4,346 tons of ore treated by concentration and flotation yielded 1,257 tons of lead concentrate (containing 44 ounces of gold, 13,315 ounces of silver, 5,538 pounds of copper, 600,426 pounds of lead, and 116,121 pounds of zinc) and 563 tons of zinc concentrate (containing 10 ounces of gold, 2,412 ounces of silver, 2,325 pounds of copper, 57,886 pounds of lead, and 596,308 pounds of zinc). The company mill was remodeled during the year but was not operated. L. D. Foreman shipped old slag, valuable chiefly for lead, from the Last Chance and Lane mines to a smelter.

Fish Springs district.—Eugene Kraft, a lessee, worked the Montezuma mine from March 1 to December 30, 1943; 28 tons of lead ore (containing 3 ounces of gold, 257 ounces of silver, and 8,144 pounds of lead) and 92 tons of zinc-lead ore (containing 4 ounces of gold, 937 ounces of silver, 471 pounds of copper, 19,493 pounds of lead, and 24,551 pounds of zinc) were shipped to smelters.

Modoc district.—E. H. Snyder operated the Colorado group during the first half of 1943; then all operations were suspended. Zinc ore was shipped to a smelter and concentrator. C. C. King shipped lead ore to a smelter from the Defense mine during 1943.

Resting Springs district.—Shoshone Mines, Inc., shipped ore from the Columbia No. 2 mine throughout 1943 and was the largest producer of lead and silver in the State; 22,456 tons of ore shipped to a smelter contained 3,143 ounces of gold, 152,893 ounces of silver, 8,438 pounds of copper, 6,221,280 pounds of lead, and 3,105,820 pounds of zinc.

Slate Range district.—Damon & Damon carried on a development program at the Gold Bottom mine during 1943 and shipped to smelters 2,850 tons of gold-silver ore (containing 380 ounces of gold, 11,380 ounces of silver, 25,222 pounds of copper, and 204,318 pounds of lead) and 757 tons of zinc ore (containing 24 ounces of gold, 1,400 ounces of silver, 6,407 pounds of copper, 58,097 pounds of lead, and 188,718 pounds of zinc). Late in the year a 150-ton flotation mill, reconstructed largely from the equipment derived from dismantling the Mineral Reduction Co. custom mill at Benton Station, was being installed. C. O. Mittendorf shipped lead ore to a smelter from the Ophir mine.

KERN COUNTY

Gorman district.—W. W. Stabler shipped zinc ore to a smelter during 1943 from the Condor mine, formerly known as the Cully Hayes property.

Mojave district.—All important mines in the Mojave district were reported inactive in 1943 as a result of War Production Board Order L–208. Some gold and silver, however, were recovered from clean-ups at mills in the district.

Randsburg district.—The Holcomb Valley Placer Co., lessee of the Monarch Rand mine, produced gold in 1943 as a byproduct of a placer operation carried on primarily for scheelite; gravel was delivered by carry-all to a stationary washing plant. Placer Concentrators also produced gold as a byproduct from a placer scheelite operation at the Patsy and Victory No. 2 mines. Rand Gold Dredging Associates operated a connected-bucket dredge with 82 3-cubic foot buckets at the Tungold mine from January 1 until the dredge capsized June 10; a substantial quantity of gold was recovered, and measures were taken to right the dredge so that operations could be resumed.

LOS ANGELES COUNTY

San Gabriel district.—Robert A. Riggs reported recovery of 26 ounces of gold and 4 ounces of silver as a byproduct in preparing sand and gravel for concrete aggregate. The Consolidated Rocks Production Co. also recovered gold and silver as a byproduct from its gravel-plant operations.

MADERA COUNTY

Daulton district.—The West Lode Reduction Co. recovered copper precipitates by treating mine water from the Daulton mine with scrap iron. Pietro Rosati shipped copper ore to a smelter from the Victory mine.

MARIPOSA COUNTY

East Belt district.—The Bandarita mine was operated by the Bandarita Mining Co. from January 1 to October 1943, when work was taken over by G. A. Ogden; 117 tons of ore and 35 tons of old tailings yielded amalgamation bullion containing 27 ounces of gold and 6 ounces of silver and 2 tons of flotation concentrates containing 7 ounces of gold and 3 ounces of silver. Russell Wilson worked the Feliciana mine from January 1 to July 15, when all production was suspended; 501 tons of gold ore yielded amalgamation bullion containing 495 ounces of gold and 76 ounces of silver and 29 tons of concentrates containing 151 ounces of gold and 39 ounces of silver. Schroeder, Odgers, & Schroeder worked the Schroeder group in the Colorado section of the East Belt district throughout the year; amalgamation of 145 tons of ore yielded 195 ounces of gold and 27 ounces of silver.

Hunter Valley district.—The Mount Gaines Mining Co. was permitted by the War Production Board Order to produce on a restricted basis throughout 1943. Gold ore was treated by amalgamation with flotation. Ernest L. Buerki operated the Ruth Pierce mine during the year, treated 506 tons of old tailings by cyanidation, and recovered 28 ounces of gold and 21 ounces of silver.

Mother Lode district.—P. A. Johns operated the Nelly Kaho mine throughout 1943, treated 196 tons of ore by amalgamation, and recovered 69 ounces of gold and 7 ounces of silver. The Pacific Mining Co. worked the Pine Tree and Josephine mines the entire year; ore was treated at the company 175-ton flotation mill.

NEVADA COUNTY

Grass Valley-Nevada City district.—The Empire Star Mines Co., Ltd., recovered a substantial quantity of gold in 1943 in a mill clean-up during the mine-operation suspension resulting from War Production Board Order L–208. A section of the company North Star mine was operated by the New Verde Mines Co. under special permit from the War Production Board, granted because of the tungsten content of the ore; the principal product was gold. Both the Empire Star Mines Co., Ltd., and the New Verde Mines Co. are affiliates of the Newmont Mining Corporation. The Lava Cap Gold Mining Corporation continued operations from January 1 until June 30, when the War Production Board failed to renew a special permit under which the property was permitted to operate to supply fluxing material. The breaking of ore ceased June 7 and all production June 30; 47,245 tons of ore were treated in the company 400-ton mill. The mill comprised a 400-ton flotation unit, a 25-ton concentrate and middling cyanide unit, and a 350-ton tailing cyanide unit. Cyanide precipitates (containing 675 ounces of gold and 6,502 ounces of silver) and 1,739 tons of flotation concentrates (containing 10,206 ounces of gold, 90,631 ounces of silver, 7,485 pounds of copper, and 18,379 pounds of lead) were produced.

Washington district.—A clean-up of bed rock at the Omega mine yielded 64 ounces of gold and 2 ounces of silver. A clean-up at the Bradley Mining Co. Spanish mine yielded 32 tons of gold ore, shipped to a smelter.

ORANGE COUNTY

Lake Elsinore district.—The Ortega Mining Co. worked the Ortega mine, formerly known as the Old Dominion, from January 1 to October 30, 1943, and shipped silver ore to a smelter.

PLACER COUNTY

Foresthill district.—C. J. Oudin worked the Miller Slope drift mine throughout 1943; 50 cubic yards of gravel yielded 15 ounces of gold and 2 ounces of silver.

Lincoln district.—Goodwin M. Trent worked the Valley View mine for 8 months during 1943 and shipped 52 tons of ore containing 9 ounces of gold, 57 ounces of silver, and 1,871 pounds of copper to a smelter.

Ophir district.—Substantial quantities of gold bullion and gold concentrates were recovered from a clean-up at the Oro Fino mine of Oro Fino Consolidated Mines.

PLUMAS COUNTY

Genesee district.—J. W. Goodhue worked the Pilot mine from April 1 to December 31, 1943; 32 tons of ore shipped to a smelter contained 38 ounces of gold, 408 ounces of silver, and 11,524 pounds of copper.

Johnsville district.—Dump ore at the Jamison mine was treated by amalgamation during 1943. Lee Lakin worked the Plumas-Eureka mine under lease from May 15 to November 1 and shipped to a smelter 67 tons of old tailings containing 57 ounces of gold, 55 ounces of silver, and 4,141 pounds of lead.

SACRAMENTO COUNTY

Folsom district.—The processing of concrete aggregate by Pacific Coast Aggregates, Inc., and the Fair Oaks Gravel Co. at Fair Oaks resulted in the recovery of 249 ounces of gold and 21 ounces of silver. The Natomas Co., after suspending operations late in 1942 as a result of War Production Board Order L-208, was granted a permit to resume operations on a limited scale early in 1943; production was begun on February 1 and continued without interruption until December 31. Two of the company fleet of seven connected-bucket dredges were permitted to work. The operation was carried on under stringent restrictions with respect to labor and supplies. The inactive dredges proved a source of replacements when parts of the active dredges failed. The operating force of the company was found to include many men who were advanced in years and not available for service in war plants elsewhere.

SAN BERNARDINO COUNTY

Buckeye district.—Frank Royer shipped gold ore valuable for fluxing purposes from the Bagdad-Chase mine during 1943.

Randsburg district.—Hoefling Bros. recovered placer gold as a byproduct of an operation carried on throughout 1943 principally for scheelite at the Spud Patch mine; 597,139 cubic yards of gravel were mined with a dragline excavator, of which 134,934 cubic yards were trucked to a stationary washing plant. In addition to scheelite (nuggets of which are known locally as "spuds"), 210 ounces of gold and 45 ounces of silver were recovered.

SAN JOAQUIN COUNTY

Camanche district.—The Gold Hill Dredging Co. was permitted to operate one dredge under special permit from the War Production Board during 1943 and elected to operate its Upper Comanche dredge from January 1 to August 31 and its Lower Comanche dredge from October 1 to December 31. The Upper Comanche dredge is equipped with 66 7¾-cubic foot buckets and the Lower with 87 8½-cubic foot buckets; both use electric power. The Mokelumne Sand & Gravel Co. produced a small quantity of gold as a byproduct in preparing sand and gravel.

SHASTA COUNTY

Flat Creek district.—The Mountain Copper Co., Ltd., began production from the Mattie ore body in the Hornet mine on July 1 and continued until the end of the year. The ore was treated in a 300-ton selective-flotation mill built during 1942 and 1943, and the copper and zinc concentrates were shipped to smelters. In addition, a small quantity of copper ore and copper precipitates recovered from mine water was shipped to a smelter.

Redding district.—The Columbia Construction Co., Inc., recovered 1,555 ounces of gold and 166 ounces of silver as a byproduct during production of 1,500,000 cubic yards of sand and gravel for use in the construction of Shasta Dam. A feature of the operation was a conveyor belt that transported the sand and gravel from the washing plant in the bed of the Sacramento River at Redding to the site of the dam 11 miles distant.

SIERRA COUNTY

Alleghany district.—The American Hill Mining Co. worked the American Hill and Pilgrim Annex mine from July to December 24, 1943; 60 tons of ore were amalgamated and yielded 25 ounces of gold and 3 ounces of silver. The Original Sixteen to One Mine, Inc., carried on limited operations throughout 1943 under permit of the War Production Board. Gold ore was treated by amalgamation and table concentration.

Downieville district.—Ruby Mine continued operations on a maintenance basis at the Ruby drift mine throughout 1943 and produced 323 ounces of gold and 12 ounces of silver from 500 cubic yards of gravel.

Pike district.—W. C. Ennis worked the Bowman and Queen Mary mines, under lease, the entire year; recovery by amalgamation from the former was 81 ounces of gold and 13 ounces of silver from 265 tons of ore and from the latter 34 ounces of gold and 11 ounces of silver from 250 tons of ore.

Poker Flat district.—Hydraulic operations were carried on at the Pioneer Project mine for 3 months during 1943, and a substantial quantity of gold was recovered. C. S. Poor worked the Tennessee Manxman drift mine from January 1 to November 1 and recovered 74 ounces of gold and 8 ounces of silver from 680 cubic yards of gravel.

SISKIYOU COUNTY

Klamath River district.—Larson & Harms recovered 114 ounces of gold and 18 ounces of silver in 1943 from concentrates accumulated at the company Moccasin dragline dredge operation before closing it as a result of War Production Board Order L–208. The Gray Eagle Copper Co. began production at the Dakin or Gray Eagle mine upon completion of the company 700-ton flotation mill in March; 145,165 tons of copper ore yielded 26,666 tons of copper concentrate containing 2,486 ounces of gold, 9,332 ounces of silver, and 10,446,467 pounds of copper. This new producer supplied 58 percent of the copper output of the State during the year.

Liberty district.—E. A. McBroom hydraulicked at the Farnsworth mine from March 1 to May 10, 1943; 500 cubic yards of gravel yielded 22 ounces of gold and 2 ounces of silver.

Scott Bar district.—George C. Noonan and George A. Milne carried on underground quartz-mining operations at the Quartz Hill mine during 1943.

STANISLAUS COUNTY

Knights Ferry district.—The Placer Properties Co. operated a dragline dredge on the Stanislaus River, 8 miles east of Oakdale, from January 1 to December 12, 1943. A. G. Germain operated a dragline dredge, using a dragline excavator with a ½-cubic yard bucket, intermittently from July 15 to December 23. The washing of 655 cubic yards of gravel yielded 12 ounces of gold and 1 ounce of silver. The equipment was designed to be handled by one workman.

La Grange district.—The Tuolumne Gold Dredging Corporation operated a connected-bucket dredge, equipped with 100 12-cubic foot buckets, throughout 1943 on a one-shift basis.

TRINITY COUNTY

Junction City district.—The Goldfield Consolidated Mines Co. hydraulicked at the Red Hill mine from January 1 to December 31, 1943.

TULARE COUNTY

Camp Nelson district.—Chas. T. Williams, a lessee, shipped 6 tons of lead ore from the Cedar Hill mine to a smelter; the ore contained 486 ounces of silver and 6,154 pounds of lead.

TUOLUMNE COUNTY

East Belt district.—Harper Bros. worked the Eureka mine from January 10 to December 15, 1943; 15 tons of ore treated by amalgamation yielded 55 ounces of gold and 12 ounces of silver. F. L. Macpherson carried on development at the Indian Girl mine during the first 3 months of the year.

Mother Lode district.—Miller & Clemson, operating in 1943 as Eagle Shawmut Mine, treated 155,500 tons of gold ore in a 500-ton flotation mill at the Eagle Shawmut mine; amalgamation bullion (containing 279 ounces of gold and 83 ounces of silver) and 3,392 tons of concentrates (containing 9,921 ounces of gold, 3,455 ounces of silver, and 8,251 pounds of copper) were recovered. The War Production Board permitted the mine to operate because the concentrates were needed for the efficient operation of the Selby smelter of the American Smelting & Refining Co. During the year the company made preparations at the Eagle Shawmut mill to handle ore to be trucked from the Penn mine, Campo Seco district, Calaveras County.

YUBA COUNTY

Challenge district.—H. M. Richards did ground sluicing at Ohio Flat and recovered 23 ounces of gold from 1,000 cubic yards of gravel between January 1 and April 15, 1943.

Smartville district.—Operation by the Williams Bar Dredging Co. was suspended on January 13, 1943, under War Production Board Order L-208.

Yuba River district.—Yuba Consolidated Gold Fields was permitted to operate two of its fleet of six dredges from January 1 to December 31, 1943. The dredges in operation were both of Yuba type and used electric power; one had 126 and the other 135 18-cubic foot buckets.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES

(MINE REPORT)

By A. J. Martin

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SUMMARY

With few exceptions, the equipped copper, lead, and zinc mines in the Central States were worked throughout 1943 to the fullest extent possible under limitations imposed by labor shortage, material-supply problems, and a damaging flood in the Tri-State zinc-lead region of Kansas, Missouri, and Oklahoma. As the year began copper and zinc were in group I of the War Production Board Material Substitutions and Supply List, and great emphasis was placed on increasing the output of these metals, although continuance of high lead production was also considered essential. During the year additional old mines containing normally submarginal ores were reopened and equipped for wartime operation at premium prices or under Government loans or contracts, and 14 worth-while newly developed mines were brought to the productive stage. Expanded use of labor-saving machinery partly offset manpower shortages and enabled many mines to increase crude-ore output. The use of machinery did not always reduce costs materially, especially at small mines. Decreased labor efficiency and wage increases added to operating costs. Therefore, to maintain necessary production under the ceiling metal prices most mine quotas had to be adjusted downward to provide additional Government premiums, or the Government bought the concentrates or metal at special prices. The drive for increasing zinc production from marginal and submarginal ores eased late in October, when B- and C-level premiums were denied to mines not already operating and the Government ceased financing new zinc projects. In November notice was given that applications for special copper premiums would not be accepted after December 31, 1943. The output of both crude mine ore and reclaimed old tailings increased in 1943, but the average metal content of all classes of material treated (except copper tailings) decreased. The most pronounced decrease occurred in zinc and zinc-lead ores and old tailings, and the output of recoverable zinc decreased 14 percent from 1942. Lead output decreased 8 percent, and copper increased 2 percent. The "mine" value of the output of all three metals rose materially in 1943 owing to increases in Government bonuses to mine operators; the market prices of the metals at smelters were not changed.

The silver produced in the Central States is a minor byproduct derived from some of the base-metal ores. No mine production of gold was reported in the Central States from 1941 to 1943, inclusive.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of January 31, 1934. Treasury legal coinage value of gold from January 18, 1837, to January 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in the Central States, 1939–43, in terms of recovered metals

Year	Mines producing	Ore and old tailings (short tons)	Gold		Silver	
			Fine ounces	Value	Fine ounces	Value
1939	251	22,972,151	[1] 4	$140	315,953	$214,465
1940	416	25,532,085	[1] 5	175	353,737	251,546
1941	447	28,959,189			448,824	319,164
1942	502	30,726,994			130,884	93,073
1943	407	32,653,764			161,917	115,141

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
1939	87,970,000	$9,148,880	198,481	$18,657,214	231,716	$24,098,464	$52,119,163
1940	91,766,000	10,369,558	207,587	20,758,700	244,976	30,866,976	62,246,955
1941	95,680,000	11,290,240	209,362	23,867,268	276,006	41,400,900	76,877,572
1942	93,958,000	11,368,918	235,229	31,520,686	258,181	48,021,666	91,004,343
1943	96,208,000	12,507,040	217,060	32,559,000	222,707	48,104,712	93,285,893

[1] From placer prospecting.

Silver.—The mine output of silver in the Central States in 1943 comprised 111,285 ounces derived from refining lead bullion recovered from Southeastern Missouri lead ores, 48,479 ounces from Michigan copper ore, and 2,153 ounces from galena concentrates produced in milling Southern Illinois zinc-lead fluorspar and lead fluorspar ores.

Copper.—Michigan mines yielded 97 percent of the Central States total output of recoverable copper in 1943; the State production increased 2 percent over 1942. The Southeastern Missouri region produced 1,340 tons of recoverable copper in 1943, all a byproduct made in smelting lead concentrates. Ore containing lead, copper, cobalt, nickel, and iron was mined in development at Fredericktown and stock-piled for treatment upon completion of a mill being constructed. One unit of the mill began operating in February 1944 and made copper concentrates as one of the products.

Lead.—Mines in Southeastern Missouri continued to supply most of the lead produced in the Central States, but their total output of recoverable lead declined 9 percent in 1943 from 1942. Some lead ore from the newly developed Park City Consolidated mine and lead-copper-cobalt-nickel-iron ore from the St. Louis Smelting & Refining Co. property were extracted in development and stock-piled pending completion of a mill under construction on each of the properties; both mills began operating early in 1944. Lead production in the Tri-State district (Kansas, Oklahoma, and Southwestern Missouri) increased slightly. The combined output of Arkansas, Central Missouri, Illinois, Kentucky, and Wisconsin decreased slightly.

Zinc.—The Tri-State region contributed 90 percent of the Central States total mine output of zinc in 1943 and 92 percent in 1942. A general review of mining and milling in this region is given in this chapter under Southwestern Missouri. Zinc production in the Wisconsin-Northern Illinois (Upper Mississippi Valley) district increased materially in 1943. In the Southern Illinois-Kentucky zinc-lead fluorspar region the greatest efforts were directed toward expanding production of fluorspar, and the output of zinc decreased. Other small zinc-producing areas included Southeastern and Central Missouri; Owen County, Ky.; Northern Arkansas; and Arbuckle Mountains (Southern Oklahoma).

MINE PRODUCTION BY STATES AND REGIONS

Mine production of silver, copper, lead, and zinc in the Central States in 1943, by States, in terms of recovered metals

State	Mines producing	Material sold or treated		Silver	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value
Arkansas	7	4,342			
Illinois	15	[1] 97,879		2,153	$1,531
Kansas	82	2,790,570	1,685,197		
Kentucky	7	[1] 23,818			
Michigan	11	2,311,669	2,091,925	48,479	34,474
Missouri	94	8,603,750	836,401	111,285	79,136
Oklahoma	122	4,779,407	8,880,784		
Wisconsin	69	413,876	134,146		
	407	19,025,311	13,628,453	161,917	115,141
Total, 1942	502	17,970,879	12,756,115	130,884	93,073

State	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
Arkansas			1	$150	96	$20,736	$20,886
Illinois			2,043	306,450	5,851	1,263,816	1,571,797
Kansas			9,213	1,381,950	56,944	12,299,904	13,681,854
Kentucky			240	36,000	931	201,096	237,096
Michigan	93,528,000	$12,158,640					12,193,114
Missouri	2,680,000	348,400	184,910	27,736,500	30,413	6,569,208	34,733,244
Oklahoma			19,733	2,959,950	114,085	24,642,360	27,602,310
Wisconsin			920	138,000	14,387	3,107,592	3,245,592
	96,208,000	12,507,040	217,060	32,559,000	222,707	48,104,712	93,285,893
Total, 1942	93,958,000	11,368,918	235,229	31,520,686	258,181	48,021,666	91,004,343

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[1] Excludes lead-bearing material mined with fluorspar and from which some lead was recovered as a byproduct of the mining and milling of the fluorspar.

Of the seven lead- and zinc-producing regions in the Central States, three are not limited to a single State. The output, by regions, in 1943 is given in the following table.

Mine production of lead and zinc in the Central States in 1943, by regions

Region	Lead[1]		Zinc[2]		Total value
	Short tons	Value	Short tons	Value	
Concentrates:					
Joplin or Tri-State	46, 345	$5, 575, 240	376. 236	$37, 593, 954	$43, 169, 194
Southeastern Missouri	257, 145	18, 475, 374	2, 009	78, 047	18, 553, 421
Upper Mississippi Valley[3]	1, 430	120, 788	28, 768	1, 745, 906	1, 866, 694
Kentucky-Southern Illinois	3, 374	249, 963	9, 996	645, 916	895, 879
Central Missouri	160	15, 039	275	21, 663	36, 702
Northern Arkansas	1	71	235	13, 934	14, 005
Arbuckle Mountains (Okla.)	----------	----------	9	760	760
	308, 455	24, 436, 475	417, 528	40, 100, 180	64, 536, 655
Total, 1942[4]	327, 463	24, 265, 509	481, 342	33, 034, 563	57, 300, 072
Recoverable metal:					
Joplin or Tri-State	34, 722	5, 208, 300	200, 514	43, 311, 024	48, 519, 324
Southeastern Missouri	179, 012	26, 851, 800	[5] 820	177, 120	27, 028, 920
Upper Mississippi Valley[3]	1, 004	150, 600	15, 539	3, 356, 424	3, 507, 024
Kentucky-Southern Illinois	2, 199	329, 850	5, 630	1, 216, 080	1, 545, 930
Central Missouri	122	18, 300	103	22, 248	40, 548
Northern Arkansas	1	150	96	20, 736	20, 886
Arbuckle Mountains (Okla.)	----------	----------	5	1, 080	1, 080
	217, 060	32, 559, 000	222, 707	48, 104, 712	80, 663, 712
Total, 1942[4]	235, 229	31, 520, 686	258, 181	48, 021, 666	79, 542, 352

[1] Includes galena and small quantity of lead carbonate concentrates.

[2] Includes sphalerite and small quantity of zinc carbonate and silicate concentrates.

[3] Region includes Iowa, Northern Illinois, and Wisconsin; no production in Iowa from 1918 to 1943, inclusive.

[4] No production in Arbuckle Mountains region in 1942.

[5] Includes 360 tons recovered from lead-smelter slags.

Quantity and tenor of copper, lead, and zinc ores, old tailings, etc., produced in some[1] Central States, 1941–43, by States

State	1941		1942		1943	
	Ore, etc.	Metal content[2]	Ore, etc.	Metal content[2]	Ore, etc.	Metal content[2]
	Short tons	*Percent*	*Short tons*	*Percent*	*Short tons*	*Percent*
Kansas	3, 696, 247	2. 55	3, 872, 052	1. 85	4, 475, 767	1. 62
Michigan	4, 282, 448	1. 08	4, 362, 640	1. 05	4, 403, 594	1. 06
Missouri	6, 792, 594	2. 85	9, 298, 758	2. 63	9, 440, 151	2. 36
Oklahoma	13, 883, 989	1. 52	12, 798, 423	1. 45	13, 660, 191	1. 08
Wisconsin	211, 973	3. 86	301, 674	3. 74	548, 022	3. 09
	28, 867, 251	----------	30, 633, 547	----------	32, 527, 725	----------

[1] Only small-scale intermittent mining done in Arkansas from 1918 to 1943; Kentucky and Illinois excluded because part of the metal output (lead and zinc) was a byproduct of fluorspar mining, and the quantity of metal-bearing material hoisted could not be determined.

[2] The percentages represent metal content of the ore insofar as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in other Central States the metals are lead and zinc combined, relative proportions of which are shown in third table of this chapter and in tables of tenor of ore given in sections devoted to the respective States.

MINING AND METALLURGIC INDUSTRY

Under the ceiling metal prices that prevailed in 1943, the extent to which copper, lead, and zinc mine operators in the Central States could expand mining and development to maintain desired metal production from the low-grade ores (which constitute the bulk of the reserves) was governed largely by the amount of bonus or other form of Federal aid provided and the supply of manpower and materials available. The broadened Premium Price Plan permitted downward adjustment of quotas where required to maintain output, and large increases occurred in total premium payments to copper, zinc, and zinc-lead mines and tailing mills; the principal producing lead mines continued to operate without benefit of the Government premium. The Government, through the Reconstruction Finance Corporation and its subsidiaries, as well as the Bureau of Mines and the Geological Survey, in cooperation with the War Production Board, sponsored mining, development, prospecting (including examination, ore testing, and drilling), and milling projects designed to maintain necessary production and provide additional ore reserves. The principal new developments in mining in 1943 were the use of jumbo drill holders in certain large open stopes of zinc-lead mines in the Tri-State district and the extended use of mechanical loaders in the smaller mines. Flotation was used in conjunction with gravity concentration in nearly all the mills, and flotation concentrates comprised 25 percent of the total copper concentrates, 44 percent of the lead concentrates, and 57 percent of the zinc concentrates produced. The concentrates generally have an established market, although war conditions caused some diversions from customary channels. Copper concentrates from Michigan were smelted in plants at Hubbell and Houghton. The lead concentrates from Southeastern Missouri were sent to the Herculaneum (Mo.) and Alton (Ill.) smelters; those from the Tri-State district went mostly to the Galena (Kans.) smelter, other destinations being smelters at Herculaneum and Alton and oxide plants at Coffeyville, Kans., and Hillsboro, Ill. Zinc concentrates from the Tri-State district moved to plants at Bartlesville and Henryetta, Okla.; Coffeyville, Kans.; Fort Smith and Van Buren, Ark.; Danville, East St. Louis, Hillsboro, and La Salle, Ill.; Donora, Pa.; and Moundsville and Meadowbrook, W. Va. The lead and zinc concentrates from Wisconsin, Illinois, and other scattered districts in the Central States were shipped to one or more of the foregoing plants.

REVIEW BY STATES

ARKANSAS

Zinc and lead mining in Arkansas in 1943 was confined to intermittent small-scale operations. Zinc concentrates shipped totaled 235 tons—283 tons less than in 1942—and comprised 125 tons of sulfide, containing 55.20 percent zinc, and 110 tons of carbonate and silicate, containing 34.55 percent zinc; all were shipped to the Fort Smith (Ark.) smelter. Only 1 ton of lead concentrates was shipped in 1943 and 3 tons in 1942. Most of the mining and development done in 1943 was financed by Reconstruction Finance Corporation loans. The producing mines were the Gloria-Jack Pot (Moark) and Lead Hill in Boone County, the Silver Queen (Silver Hollow Mining Co.) in Marion County, the Baker-Brewer and Bald Hill in Newton County, the Excelsior in Searcy County, and the Fugat Hollow in Sharp County.

ILLINOIS

Northern Illinois (see section on Wisconsin for output data).—The zinc and lead ore and rougher jig zinc-lead concentrates produced in Northern Illinois in 1943 were shipped to the Vinegar Hill Zinc Co. custom flotation mill near Cuba City, Wis. Gill Bros. worked the North Unity mine from January 1 to June 15 and the adjacent Hughlett and Gray from January 1 to February 4. The Little Six Mining Co. cleaned up some additional ore from the Hughlett and Gray after it was shut down by Gill Bros. The Ginte Mining Co. built a 400-ton jig mill at the Ginte mine and operated it from September 14 through December. Part of the Ginte ore was shipped crude to the Vinegar Hill mill. Exploratory drilling by the Bureau of Mines on the Gray property south of Galena showed a large zinc deposit somewhat lower in average grade than that of the deposits being worked in the Wisconsin-Northern Illinois region. The Lonergan land near Menominee was also drilled.

Southern Illinois.—In Southern Illinois most of the output of zinc and lead continued to come from the Mahoning Mining Co. zinc-lead fluorspar mines near Cave in Rock, Hardin County. In 1943 the company operated the W. L. Davis-Deardorff, Anna L. Davis, East Green, and West Green shafts, which are 311, 165, 230, and 363 feet deep, respectively. The ore from all four shafts was trucked to the company flotation mill at Rosiclare for treatment. During the year additional units were installed in the mill, increasing its daily capacity from 200 to 320 tons. The products of the mill were fluorspar concentrates (mostly of acid grade), zinc concentrates averaging 62.89 percent zinc, and lead concentrates averaging 65.81 percent lead. Besides company ore, the mill treated a relatively small quantity of custom ore and bulk concentrates containing zinc, lead, and fluorspar from other operations, including the Aluminum Ore Co., Roberts & Frazier, and Rosiclare Lead & Fluorspar Co. mines. Hillside Fluor Spar Mines shipped byproduct lead concentrates. The Minerva Oil Co. continued developing its zinc-fluorspar property northeast of the Mahoning mines and also worked on constructing a 200-ton differential flotation mill under a Defense Plant Corporation agreement. A 645-foot double-compartment shaft was sunk, and drifts were run on the 640-foot level, from which the ore will be hoisted. The mine and mill began producing in March 1944. The total output of lead concentrates in Southern Illinois in 1943 was 3,053 tons averaging 65.48 percent lead and about 7 ounces of silver to the ton, and that of zinc concentrates was 8,302 tons averaging 62.89 percent zinc. Production (in terms of recoverable metals) amounted to 1,959 tons of lead, 2,153 ounces of silver, and 4,699 tons of zinc compared with 2,211 tons of lead, 104 ounces of silver, and 7,689 tons of zinc in 1942.

KANSAS

The Kansas zinc and lead mines are in the Tri-State (Joplin) mining region, embracing parts of Cherokee County, Kans., and Ottawa County, Okla., and about 12 counties in Southwestern Missouri. General details of the Tri-State mining industry are given in following pages on Southwestern Missouri.

The Kansas output of zinc and lead varied little in 1943 from 1942. The largest part of the production continued to come from the Baxter Springs-Blue Mound-Treece area, which yielded 97,852 tons of zinc concentrates and 12,117 tons of lead concentrates in 1943 compared with 96,856 and 12,183 tons, respectively, in 1942. About 41 percent of the total crude ore mined in the area in 1943 was concentrated in the Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin, Okla. Most of the ore was transported to the mill over the Northeast Oklahoma Railroad, which has spur tracks from the main line to the principal ore-hoisting shafts. The Eagle-Picher Westside mines, Webber mines, Big John, Black Eagle, Leopard, Parmenter, and Wilbur mines were among the large producers in 1943. Part of the crude ore from the Westside (Barr) was milled in the Westside mill until May, when the mill was shut down; the rest of the Westside crude-ore output and all of that from the other mines was sent to the company Central mill at Cardin, Okla. Kansas mines shipping custom ore to the Central mill included the Bendelari, Ebenstein (Bilwil), Guaranty No. 2 (Robob), Ozark (Henshaw), and Wright. The Paxson mine and mill, reopened by Eagle-Picher as agent for the Metals Reserve Co., were operated from April through December, and the adjoining newly developed Stoskopf and Swalley "D" mines, included in the Paxson operation, also began producing during the year.

The Ballard central mill of the St. Louis Smelting & Refining Co. continued to treat mine dirt from the company Ballard, Bailey, Clark, English "O", Keith, Shanks, Slaughter, and Walter H. mines. The company Moore mine was under development. The Beck Mining Co. No. 3 mill at Baxter Springs operated throughout 1943, treating chiefly custom ore from the MacArthur, Southern, and Swalley mines and company ore from the Smith mine. Beginning November 1 the company also operated the Swalley mine, purchased from the Mineral Products Co. In October the Southern ore was diverted to the Youngman mill. This mill, which was enlarged during the year, treated ore mined by the Harris Mining Co. from the Robinson, Silver Fox, and Evans-Wallower No. 24 mines; it also handled ore from the Federal Muncie group, reopened in June after a 2-month shut-down following the fire that destroyed the Gordon central mill. The Bilharz Mining Co. operated its mill and three shafts on the Bilharz-Brewster property. The Dines Mining Co. mill ran on company ore from the Hartley mines and Douthat (Okla.) mine and custom ore from the Childress-Heggam (Okla.), Stebbins (C. K. & E.), Jarrett (Robinson), and other mines. The Liza Jane (Lula Bell) mine shipped ore to the Farmington mill (Okla.). The Madison (Peru) and New Blue Mound mines and mills continued producing. The Wade Bros. mill treated company ore from the Wade-Hunter and White-McKay mines and custom ore from 26 other small Kansas and Oklahoma mines. The Captain, Early Bird, and Worley tailings mills were run throughout the year.

At Galena the Eagle-Picher Mining & Smelting Co. continued development and pumping and shipped ore from the Murphy and Illinois shafts to the Bird Dog and Central mills. The Galena Mining Co. also shipped ore to these mills. In the Peacock area the Carson Mining & Milling Co. remodeled its mill and operated it from August through December on old tailings. At Lawton the Eastern Mining Co. shipped ore from the Fletcher mine to the Playter mill in Missouri.

At Waco the St. Louis Smelting & Refining Co. operated its No. 9 mill on ore from company mines in the Kansas and Missouri parts of the Waco district and custom ore from the J. M. Bennett and Oscar Bennett leases in Kansas. The F. W. Evans mill handled ore from company leases on both sides of the Kansas-Missouri State line.

Mine shipments of lead and zinc in Kansas, 1939–43

Year	Mines producing	Lead concentrates		Zinc concentrates		Metal content [1]			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	30	17,845	$1,010,106	126,235	$4,300,365	13,697	$1,287,518	68,971	$7,172,984
1940	34	15,424	907,296	105,070	4,420,360	11,927	1,192,700	57,032	7,186,032
1941	58	18,888	1,264,147	131,406	6,595,506	14,538	1,657,332	71,403	10,710,450
1942	81	12,253	1,167,302	103,247	6,926,745	9,419	1,262,146	55,874	10,392,564
1943	82	12,243	1,457,764	105,656	10,567,578	9,213	1,381,950	56,944	12,299,904

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the value of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1942–43

	1942		1943	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled .... short tons	2,170,121	1,701,931	2,790,570	1,685,197
Total concentrates produced:				
Galena .... do	12,253	....	12,235	8
Sphalerite .... do	92,540	10,707	98,859	6,797
Ratio of concentrates to ore, etc.:				
Lead .... percent	0.56	....	0.44	....
Zinc .... do	4.26	0.63	3.54	0.40
Metal content of ore, etc.: [1]				
Lead .... do	.44	....	.34	....
Zinc .... do	2.57	.36	2.13	.23
Average lead content of galena concentrates .... do	78.44	....	76.80	60.00
Average zinc content of sphalerite concentrates .... do	60.38	57.96	60.03	57.73
Average value per ton:				
Galena concentrates	$95.27	....	$119.09	$88.75
Sphalerite concentrates	65.55	$80.42	100.55	92.22

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

KENTUCKY

Production of recoverable zinc in Kentucky increased from 407 tons in 1942 to 931 tons in 1943, and lead decreased from 335 to 240 tons. All the output in 1943 was derived from sulfide ores; zinc concentrates produced totaled 1,694 tons containing 61.04 percent zinc, and lead concentrates 321 tons containing 76.01 percent lead. The Eagle-Picher Nunn mine near Marion, worked from January to August, was the principal producer of zinc; the crude ore was shipped to company mills near Cardin and Picher, Okla. The United States Coal & Coke Co. shipped byproduct zinc and lead concentrates made in milling fluorspar. The Kentucky Fluor Spar Co. shipped byproduct lead concentrates. The Corod Minerals Corporation nearly completed construction of a 150-ton custom flotation mill at Marion to treat zinc- and lead-bearing fluorspar; funds were provided under a Defense Plant Corporation agreement. In Owen County the Twin Valley Mining Co. operated the Twin Valley (old Gratz) zinc-lead mine and 100-ton jig- and flotation-concentration mill from February through December. The mine is opened by two shafts 160 and 180 feet deep. Shortage of labor prevented capacity output.

MICHIGAN

In 1943 the Lake Superior copper-mining region in Michigan completed a century of continuous activity, including 99 years of uninterrupted annual production that averaged about 95,588,000 pounds of refined copper. The smelter output for 1845 (the first productive year of this period) is recorded in Mineral Resources as 26,880 pounds and for 1916 (the peak year) as 269,794,531 pounds; in 1943 the mine production was 93,528,000 pounds. In recent years, particularly after the consolidation in 1923 of the Ahmeek, Allouez, Calumet and Hecla, Centennial, and Osceola Consolidated mining companies, the number of operating companies has been small; during the 6-year period ended in 1943 they comprised the Calumet and Hecla Consolidated Copper Co., the Copper Range Co., the Isle Royale Copper Co., and the Quincy Mining Co. When the need for expanding copper output became imperative in 1941, the Lake Superior was one of the first regions to receive the attention of Government procurement agencies with a view to utilizing ores that were submarginal under the 12-cent ceiling price. Agreements were consummated providing for purchase by the Government of copper produced from certain mines at special prices, based upon the cost of production. In 1943 some of the mines continued to receive special prices, and some received premium prices under the Premium Price Plan. The average value per pound of fine copper reported by the mine operators (including premiums for overquota production and increment from special prices) was 16.19 cents compared with 12.83 cents in 1942. The total rock treated increased from 1,952,781 tons in 1942 to 2,311,669 tons in 1943, and reclaimed old tailings decreased from 2,409,859 to 2,091,925 tons. The tailings yielded 32 percent of the total copper in 1943 and 34 percent in 1942.

The concentrate ("mineral") produced at mills in Michigan in 1943 and the mass copper shipped direct from the mines were smelted at plants of the Calumet and Hecla Consolidated Copper Co. at Hubbell and the Copper Range Co. at Houghton. Some of the copper bullion was cast into anodes and shipped to the electrolytic refinery at Laurel Hill, N. Y., where silver was recovered. Silver was also recovered by hand-picking at the mine and from some of the concentrates.

Mine production of silver and copper in Michigan, 1939–43 [1]

Year	Silver (fine ounces)	Copper			Concentrate ("mineral")		Crude ore and sands (short tons)
		Pounds	Yield				
			Pounds per ton of crude ore and sands	Percent	Pounds	Yield (percent copper)	
1939	101,878	87,970,000	19.1	0.96	136,771,339	64.3	4,603,751
1940	88,657	90,396,000	20.4	1.02	138,451,495	65.3	4,438,219
1941	60,796	92,880,000	21.7	1.08	141,100,268	65.8	4,282,448
1942	61,674	91,358,000	20.9	1.05	141,372,582	64.6	4,362,640
1943	48,479	93,528,000	21.2	1.06	143,142,155	65.3	4,403,594

[1] Figures based upon actual recovery of copper from "mineral" smelted and estimated recovery from "mineral" not smelted during year.

Value of silver and copper produced in Michigan mines, 1939–43

Year	Silver	Copper		Total
		Total	Per ton of crude ore and sands	
1939	$69,154	$9,148,880	$1.99	$9,218,034
1940	63,045	10,214,748	2.30	10,277,793
1941	43,233	10,959,840	2.56	11,003,073
1942	$43,857	[1] $11,054,318	[1] $2.53	$11,098,175
1943	34,474	[1] 12,158,640	[1] 2.76	12,193,114

[1] Value of copper calculated at average weighted price (including Government bonuses) for all domestic copper sold (see first table of this chapter, footnote 3). If calculated at actual prices paid to Michigan operators, the value of the copper was—1942: $11,722,792, or $2.69 to the ton of crude ore and sands; 1943: $15,139,831, or $3.44 to the ton.

In 1943 the Calumet and Hecla Consolidated Copper Co. operated the Ahmeek, Central, Douglass, Iroquois, No. 4 North Kearsarge, and Peninsula mines, the Ahmeek stamp mill, the Lake Linden and Tamarack reclamation plants, and the Hubbell smelter. All the mines except the Iroquois and Central were operated throughout the year. The Iroquois is a newly developed property, opened by a 1,778-foot inclined shaft started on the Peninsula property about the middle of 1942 and brought to the productive stage in February 1943. The Central mine was reopened for further exploration and development in 1942 and was in production from April 1943 to the end of the year. Pumping and other preliminary work on reopening the Centennial mine under a contract with the Metals Reserve Co. was carried on continuously in 1943, and preparations for mining on the 37th and 39th levels got well under way. On the Allouez-Douglass land a new two-compartment shaft, known as the Allouez No. 3, was sunk to an incline depth of 531 feet, and 1,223 feet of drifts and crosscuts were driven on the 400-foot level. With regard to mining costs, the annual company report to stockholders states:

> Costs of production continued to climb in 1943, due principally to the general increase in the wage scale. The cost of coal and other supplies was substantially higher. Decreased labor efficiency throughout the operations and lower grade ore at the Ahmeek branch also contributed to the general increase in costs. Toward the end of the year, however, labor efficiency was showing marked improvement, which continued into 1944.

Other extracts from company annual report follow:

> The Tamarack dredge moved into the mixed conglomerate and amygdaloid zone in November, and production from that deposit in the future is dependent entirely upon the price of copper. The plant is being remodeled for most economical treatment of low-grade amygdaloid sands. The Lake Linden dredge was in the oldest and richest conglomerate sand until December, but for the five winter months will operate in the amygdaloid sand bank, returning for the final clean-up of conglomerate in the spring. Operations in the amygdaloid are possible only because of the war demands for copper, at a premium price. The Calumet mill, idle since 1939, is being reconditioned to enable it, in conjunction with the adjoining leaching and flotation plants, to treat the conglomerate production from No. 3 Allouez. It will also treat any future production of amygdaloid rock in excess of the capacity of the Ahmeek mill. The cupro-ammonium leaching process, used by the company for treating copper-bearing tailings, was also used at the Lake Linden leaching plant in 1942 and 1943 for treating copper- and brass-coated steel scrap generated in connection with war production.

The Copper Range Co. operated its Champion and Globe mines, Freda mill, and Houghton smelter throughout 1943 and the tailings-recovery plant about 6 months. Data extracted from the annual company report to stockholders follow. Ore milled from the two mines increased from 355,630 tons in 1942 to 366,355 tons in 1943, but the production of fine copper decreased from 17,772,116 to 16,886,013 pounds. The tailings plant produced 571,674 pounds of refined copper in 1943. Since March 1, 1943, the mine production has been sold to the Government at special prices under an agreement that expired February 29, 1944, but has been extended for 3 months. The tailings plant operates under the Premium Price Plan. Exploration and development were carried on at better than average rates but resulted in no appreciable increase in ore reserves. No agreement was reached in negotiations with Government agencies for development of the White Pine property, and, unless the war need for copper justifies reopening negotiations with the Government, the company will make no attempt to develop the property until conditions warrant. The smelter continued to handle custom shipments in addition to concentrates and mass copper from company properties.

Copper production by the Isle Royale Copper Co. was 6,279,771 pounds, a 1-percent decrease from 1942. According to the annual company report to stockholders, operations in 1943 were hampered by shortage of labor and a high rate of absenteeism. The yield of refined copper per ton of rock stamped was 20.359 pounds, and the over-all production cost was 23.255 cents per pound. The stamp mill operated on a 5-day a week schedule, and owing to the low volume of rock only two heads were operated most of the time. Rock stamped totaled 308,446 tons compared with 315,142 tons in 1942. Further progress was made in mechanizing the mine. Wage increases awarded employees of the company by the Nonferrous Metals Commission in February 1943 necessitated an increase in the price of copper, and the company obtained a 1-year contract with the Metals Reserve Co., effective March 1, 1943, under which the latter agreed to buy the Isle Royale copper concentrates at a special price; the contract was renewed March 1, 1944, for 3 months.

The Quincy Mining Co. continued to operate the Quincy mine and stamp mill. Both the tonnage of rock treated and the yield of copper per ton were lower than in 1942. Beginning November 1, 1943, the company also operated its new 4,000-ton reclamation plant, erected to re-treat old stamp sands in Torch Lake. The plant includes a suction-type dredge with a pipe line on pontoons reaching from the dredge to the shore, a shore pumping-classifying plant, and a regrind-flotation mill. The shore plant and mill were designed and built by the Calumet and Hecla Consolidated Mining Co. Funds were provided through a loan of $1,150,000 obtained by the Quincy Mining Co. from the Metals Reserve Co., to be amortized by payment of 4 cents per pound of copper produced. Details of the enterprise are given in a recent publication.[1] Arcadian Mines, Inc., extended the Ripley adit about 800 feet to a total length of about 2,755 feet. Ore sent to the Ahmeek mill for a test run yielded 11 tons of copper. Work was suspended on October 15, owing to lack of funds.

MISSOURI

Missouri continued to be the largest lead-producing State and ranked eleventh in zinc production in 1943. The output of both lead and zinc was less than in 1942. Silver and copper are recovered in relatively small quantities as byproducts in smelting lead concentrates from Southeastern Missouri; the quantity of silver recovered was 111,285 ounces and copper 1,340 tons in 1943 compared with 69,106 ounces and 1,300 tons, respectively, in 1942. These two metals occur in such small quantities per ton of concentrates that no value is attached to them in the sale of the concentrates. The lead output of the State comes largely from the Southeastern Missouri region and the zinc mostly from Southwestern Missouri. In 1943 the Central district of Missouri produced small tonnages of lead and zinc concentrates; the figures are included with those of Southeastern Missouri in the table that follows.

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[1] Benedict, C. Harry, Reclaiming Quincy Tailings from Torch Lake: Eng. and Min. Jour., vol. 145, No. 4, April 1944, pp. 74-78.

Mine production of lead and zinc in Southeastern and Central Missouri, 1939–43

Year	Lead concentrates (galena)		Zinc concentrates		Metal content [1]			
					Lead		Zinc	
	Short tons	Value [2]	Short tons	Value	Short tons	Value	Short tons	Value
1939	210, 526	$12, 339, 360	----------	----------	153, 522	$14, 431, 068	----------	----------
1940	232, 871	14, 269, 600	815	$20, 000	169, 908	16, 990, 800	233	$29, 358
1941	228, 572	15, 404, 226	[3] 5, 192	73, 202	164, 388	18, 740, 232	1, 100	165, 000
1942	277, 255	19, 426, 540	[4] 1, 739	41, 913	197, 432	26, 455, 888	[5] 842	156, 612
1943	257, 305	18, 490, 413	[6] 2, 284	99, 710	179, 134	26, 870, 100	[7] 923	199, 368

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

[2] Values given are to a certain extent arbitrary, as part of the lead concentrates are smelted by the producer.

[3] Includes 4,720 tons of zinc-lead carbonate concentrates containing 893 tons of recoverable zinc and 172 tons of lead.

[4] Includes 1,280 tons of zinc-lead carbonate containing 208 tons of recoverable zinc and 28 tons of lead.

[5] Includes 450 tons recovered from lead-smelter slags.

[6] Includes 2,009 tons of zinc-lead carbonate containing 460 tons of recoverable zinc and 120 tons of lead.

[7] Includes 360 tons recovered from lead-smelter slags.

Mine production of lead and zinc in Southwestern Missouri, 1939–43

Year	Lead concentrates				Zinc concentrates				Metal content [1]			
	Galena		Carbonate		Sphalerite		Silicate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	3, 674	$199, 885	------	------	27, 741	$944, 587	949	$16, 757	2, 759	$259, 346	15, 096	$1, 569, 984
1940	2, 818	158, 556	57	$2, 446	22, 917	959, 356	807	10, 965	2, 144	214, 400	12, 470	1, 571, 220
1941	2, 084	125, 730	90	4, 379	38, 513	1, 923, 472	1, 277	14, 355	1, 521	173, 394	20, 832	3, 124, 800
1942	2, 790	303, 331	20	864	66, 881	4, 791, 020	1, 510	23, 940	2, 116	283, 544	35, 552	6, 612, 672
1943	7, 679	908, 591	------	------	56, 357	5, 724, 079	1, 037	51, 261	5, 776	866, 400	29, 490	6, 369, 840

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead ore and concentrates in Southeastern Missouri disseminated-lead district, 1939–43

	1939	1940	1941	1942	1943
Total lead ore ... short tons	5,127,000	5,837,400	5,737,230	7,107,191	6,831,377
Galena concentrates in ore ... percent	4.11	3.99	3.98	3.90	3.76
Zinc content of ore ... do	(1)	(1)	(1)	(1)	(1)
Average lead content of galena concentrates ... percent	74.4	74.45	73.81	72.65	70.99
Average value per ton of galena concentrates	$58.61	$61.28	$67.89	$70.04	$71.79

[1] Figures not available.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Southwestern Missouri, 1942–43

	1942		1943	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled ... short tons	1,404,731	751,252	1,861,044	704,125
Total concentrates produced:				
Lead ... do	2,773	37	7,658	21
Zinc ... do	59,909	8,482	51,149	6,245
Ratio of concentrates to ore, etc.:				
Lead ... percent	0.20	0.004	0.41	0.003
Zinc ... do	4.26	1.13	2.75	.89
Metal content of ores, etc.:[1]				
Lead ... do	.15	----------	.32	.002
Zinc ... do	2.48	.63	1.58	.49
Average lead content of galena concentrates ... do	77.1	64.9	76.8	66.7
Average lead content of lead carbonate ... do	50.0	----------	----------	----------
Average zinc content of sphalerite concentrates ... do	58.12	55.52	57.83	55.20
Average zinc content of silicates and carbonates ... do	23.25	----------	35.29	----------
Average value per ton:				
Galena concentrates	$108.30	$105.19	$118.40	$91.29
Lead carbonate concentrates	43.20	----------	----------	----------
Sphalerite concentrates	69.79	74.73	103.85	83.27
Zinc silicates and carbonates	15.86	----------	49.43	----------

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

Southeastern and Central Missouri.—Although production of recoverable lead in the Southeastern Missouri disseminated-lead district decreased from 197,291 tons in 1942 to 179,012 tons in 1943, the district output of lead was still much larger than that of any other district or State in the United States. The mines of the St. Joseph Lead Co. contributed most of the district output in both years. The high rate of ore extraction in recent years required a greatly expanded program of exploration and development to maintain ore reserves. Diamond drilling at four groups of company mines in St. Francois County totaled 1,240,845 feet in 1941, 2,305,272 feet in 1942, and 3,201,055 feet in 1943. Drifting and raising totaled 41,585 feet in 1941, 77,859 feet in 1942, and 69,158 feet in 1943. In 1943 the company continued to operate the Bonne Terre, Desloge, Leadwood, and Federal mills, which together have a rated daily capacity of 21,400 tons. Treatment is by table concentration followed by flotation. All the concentrates produced were lead concentrates, part of which were shipped to the Federal smelter at Alton, Ill., and part to the company smelter at Herculaneum, Mo. The concentrates contain a little silver, copper, and zinc, some of which are recovered in smelter byproducts. Some zinc was recovered as metal in 1943 at the Herculaneum smelter, where the company installed an electrothermic zinc plant with a view to adapting it to the treatment of old zinc-bearing slag from the smelter dump and new slag from current lead smelting. In Madison County the Mine La Motte mine and 1,500-ton mill of the Mine La Motte Corporation (50-percent owned by the St. Joseph Lead Co.) were run continuously. Some old tailings were included in the mill feed during the year. Mine development and drill prospecting totaled 4,336 feet of drifts and 59,507 feet of churn drilling. The Fredericktown Lead Co. operated its 400-ton mill and the Catherine and Fleming lead mines northwest of Fredericktown. The company, in cooperation with the Missouri Geological Survey, did prospect churn drilling in an undeveloped area on the Catherine property and discovered an ore body estimated to contain 250,000 tons of better than 3-percent ore, upon the basis of drilling done to the end of the year. Shaft sinking was begun early in 1944. The St. Louis Smelting & Refining Co. continued developing the leased Missouri Cobalt Co. group of mines and company-owned properties at Fredericktown and nearly completed installing a 600-ton all-flotation mill under a Defense Plant Corporation contract. The ore contains lead, copper, cobalt, nickel, and iron; that mined in development in 1943 was stock-piled. One unit of the mill began operating in February 1944, making four commercial products—lead, copper, cobalt-nickel, and iron concentrates. Before being shipped, the cobalt-nickel concentrates are treated in a reverberatory furnace and roaster installed adjacent to the mill. The Park City Consolidated Mines Co., which had drilled out a lead ore body on the Ruth property south of Fredericktown, worked on sinking a 370-foot shaft, driving development drifts, and building a 500-ton all-flotation mill during most of 1943. Work after June was financed by a Reconstruction Finance Corporation loan. Shipments of concentrates were begun in January 1944. Of the 257,145 tons of lead concentrates made in 1943 in Southeastern Missouri, about 121,712 tons were flotation concentrates.

At Valles Mines, Jefferson County, the DeSoto Lead & Zinc Co. built a 200-ton gravity-concentration mill and operated it from May through December on zinc-lead-iron ore (mostly carbonate) from dumps on the Valle Mining Co. properties in Jefferson and St. Francois Counties. The concentrates, averaging 27 percent zinc and 7 percent lead, were shipped to the Coffeyville (Kans.) pigment plant. The Bureau of Mines did exploratory churn drilling on the Ozark-McGregor zinc property near Potosi.

In Central Missouri the Wemhaner Mining Corporation continued to mine zinc, lead, and coal from the open-pit mine on the Monarch Coal & Mineral Co. land in Moniteau County. The ore was treated in the 100-ton jig mill on the property. Lessees at the Lowery property near Enon shipped some high-grade lead ore and built a small mill.

Southwestern Missouri.—The first five paragraphs and the graphs under this heading pertain to the Tri-State mining industry as a whole; the remaining text reviews mining and milling in Southwestern Missouri only.

The Tri-State region continued to be much the largest zinc-producing region in the United States, although it contributed only 27 percent of the total domestic mine output of zinc in 1943 compared with 31 percent in 1942, 35 percent in 1941 and in 1940, and 38 percent in each of the 3 preceding years. Production of zinc concentrates decreased from 478,403 tons in 1941 to 443,847 in 1942 and 376,236 in 1943. Lead concentrates decreased from 53,690 tons in 1941 to 44,857 in 1942 and then increased to 46,345 in 1943. The decreases in zinc in the past 2 years were due primarily to depletion of high-grade ore reserves, but part of the larger decrease in 1943 is attributable to set-backs in operating schedules caused by labor shortage, the destruction of two large mills by fire, and extensive damage done by a record flood in May. About 58 mills were operating in the region in December 1943 (including 17 tailing mills) compared with 51 in December 1942 (including 15 tailing mills). Production of zinc concentrates from old tailings was 56,857 tons in 1943 compared with 65,096 in 1942. Stocks of concentrates in mill bins were small at the end of 1943, but a sizable tonnage of zinc concentrates was accumulated later at the Paxson mill—a Metals Reserve Co. project.

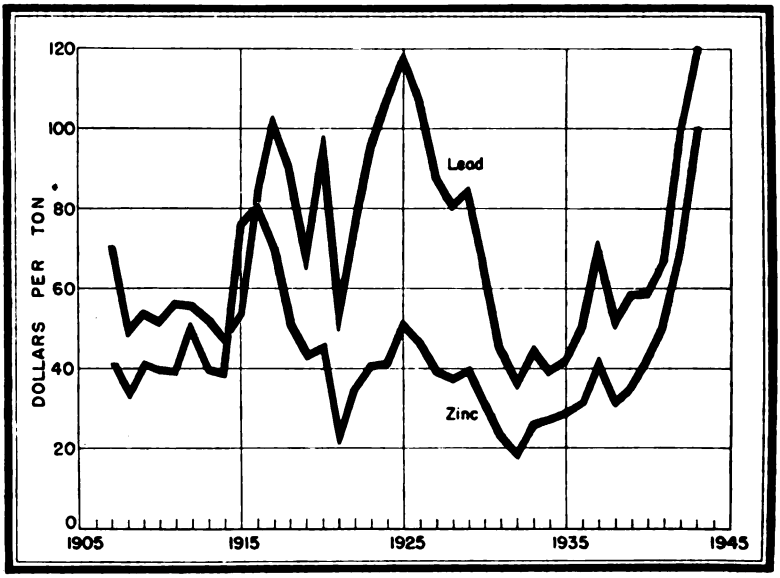

FIGURE 1.—Average prices received by sellers per ton of concentrates in the Tri-State district, 1907–43.

The method of marketing the mine output of the Tri-State or Joplin region is explained in the reports of this series for 1940 and 1941. The total value given for all concentrates produced in the region is based upon actual receipts by the sellers, including premiums paid by the Government since February 1, 1942, for overquota mine production. Under the ceiling prices of 8.25 cents a pound for zinc and 6.35 for lead at East St. Louis, the quoted weekly market price for zinc concentrates at Joplin remained $55.28 a ton throughout 1943 and that for lead concentrates $76.54. Government premiums were paid on most of the concentrates sold in 1943, the amount paid depending upon the quota levels assigned to the individual mine.

An A-level quota carried a premium of $29.70 a ton for 60-percent zinc concentrates and $41.80 for 80-percent lead concentrates; B-level, $59.40 and $83.60; and C-level (applies to zinc only) $89.10. The average total price in 1943 was $99.92 a ton for zinc concentrates and $120.30 for lead concentrates compared with $69.63 and $99.36, respectively, in 1942.

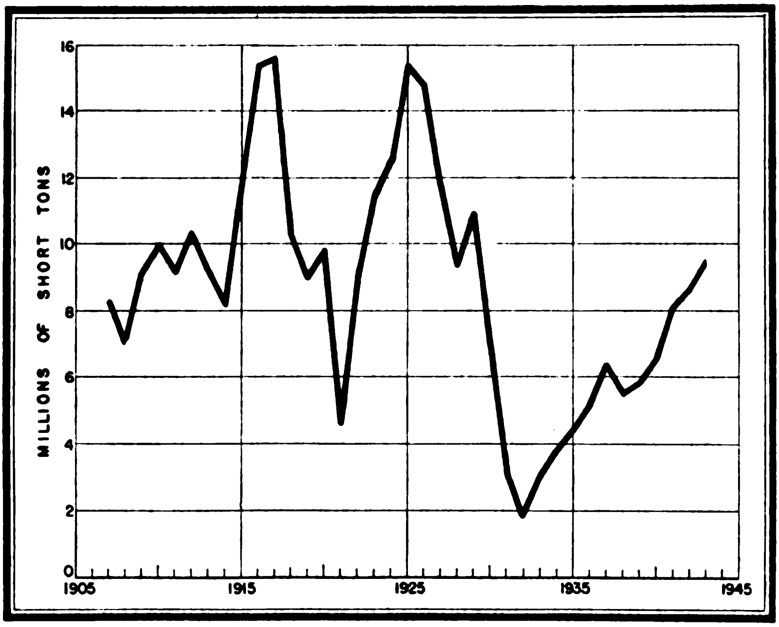

FIGURE 2.—Quantity of crude ore milled in the Tri-State district, 1907–43.

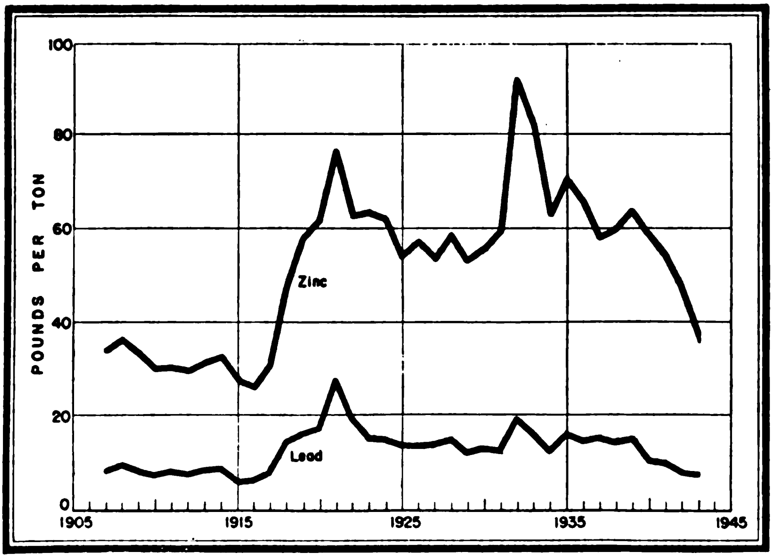

FIGURE 3.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–43.

The mining companies continued prospect drilling in outlying areas in 1943 but found little ore. One new shaft 349 feet deep was sunk in previously drilled ground in Oklahoma 4 miles farther west than any present or former productive Tri-State mine workings. About 17 new shafts (averaging 200 feet in depth) were sunk in productive areas, and nearly as many old shafts were reopened; the number of old shafts closed, however, exceeded the number reopened. In August the National War Labor Board authorized all Tri-State mining companies to increase wages of miners not to exceed 50 cents a day, and increases were granted immediately upon approval of individual applications. Most of the mines are now equipped with drags or other types of underground mechanical loaders. An innovation in the field was the use in some Eagle-Picher mines of specially designed caterpillar jumbo drill holders, which increased materially the quantity of rock broken per drill. Valuable data on drill performance, mechanical loading, haulage, and other items involved in the extensive operations of the Eagle-Picher Mining & Smelting Co. (many of which exemplify general Tri-State practice) are given in the November 1943 issue of the Engineering and Mining Journal, designated Eagle-Picher number.

Federal agencies working to aid in maintaining zinc production in the Tri-State district comprised the War Production Board local office of priorities, material supply, and regulations; the Reconstruction Finance Corporation mine loan office; the Metals Reserve Co. agent handling premium payments and other agents operating certain marginal mines west of Baxter Springs and drilling to check ore reserves in the Webb City area; the Defense Plant Corporation; the Bureau of Mines district office for exploratory work on zinc deposits, in which the Geological Survey cooperated; and the United States Employment Service (War Manpower Commission).

In Southwestern Missouri zinc production was seriously hampered by a flood in May, which inundated large surface and underground areas, causing damage to certain shafts, mine workings, and installations that required several months to repair. The worst damage was in the Oronogo and Stotts City areas. The Oronogo Circle open-pit mine of the Oronogo Mutual Mining Co. was shut down completely for several weeks and was then worked only on upper levels until drainage was completed in December. Despite this set-back the mine continued to be the largest producer of zinc in Missouri. Part of the ore was treated in the Eagle-Picher American mill at Oronogo, and part was shipped to the Bird Dog mill in Oklahoma.

Other large Missouri producers were: Kansas Explorations, Inc., operating the Snapp and Buckingham mines and the Snapp mill near Oronogo and the Jasper mine and mill near Joplin; Federal Mining & Smelting Co., operating the Granby-American and Davis groups of mines and mill at Granby and the Duenweg mine (reopened in April) and new mill at Duenweg; St. Louis Smelting & Refining Co. and F. W. Evans Mines, both of which shipped ore from mines in the Missouri part of the Waco district to their respective mills in the Kansas part; Eagle-Picher Mining & Smelting Co., operating mines and the Navy Bean mill in the Wentworth area; and American Zinc, Lead & Smelting Co., operating the newly developed Smith and Henckel mines near Duenweg after March and the Hunter mine and new 400-ton mill at Aurora after August. Cooley Bros. stripped overburden on the Sucker Flat property at Webb City from January to August and built a washing-concentrating plant designed to treat the type of ore found there. The plant consists chiefly of a large trommel screen, jigs, and tailing stackers; it began operating in September, making zinc-iron and lead concentrates which were shipped to the Ozark pigment plant at Coffeyville, Kans. Coarse rock that required crushing was stacked separately, and some of it was sent to custom mills.

The Playter mill at Waco, the St. Louis Mining & Milling Co. mill near Thoms Station, and the Southside near Joplin treated company and custom ores. Sizable custom-ore shippers included Glenn Richey at Smithfield, the Coble Mining Co. at Thoms Station, Miller & Ritter and the O'Jack Mining Co. near Joplin, and Fenix & Sons at Oronogo. The Northside mill near Joplin, the Fenix & Martin mill at Oronogo, and the Capital at Stotts City treated company ore. The Wentworth Mining & Milling Co. ran the Kline mine and mill from January to March. The Bureau of Mines did exploratory drilling on this property, on the Capital property at Stotts City, and on the Monark and Mary Arnold properties near Ozark. Brown & Root, as agent for the Metals Reserve Co., did 45,300 feet of churn drilling in the old Webb City field to check previous drill records and other data on ore reserves compiled in cooperation with the Bureau of Mines. The tailing-mill production came chiefly from the Missouri-Chitwood mill near Joplin and the Sciota at Webb City. Small mine or tailing mills near Neck City, Aurora, Diamond, Duenweg, Joplin, Ozark, and Webb City produced some sulfide concentrates. The zinc carbonate shipped from Newton County in 1943 totaled 783 tons averaging 40 percent zinc; it comprised concentrates from the new 250-ton Southwest mill at Stark City and a few cars of sorted lump ore from Granby. Some lower-grade carbonate was shipped from the Alice mine near West Plains.

OKLAHOMA

General details of mining and milling in the Tri-State region—which includes Northeastern Oklahoma—are given in the preceding pages on Southwestern Missouri. The Oklahoma area produced 57 percent of the total Tri-State output of both zinc and lead in 1943 compared with 62 percent of the zinc and 66 percent of the lead in 1942. Production of recoverable zinc decreased 22 percent from 1942 and lead 13 percent. Three unpredictable incidents impeded production in 1943. The first was destruction by fire in February of the Rialto No. 2 mill, shaft head frame, and compressor plant, with subsequent idleness at the Rialto No. 2 mine for about 3 months; the No. 2 mill was not rebuilt, but the company No. 3 mill was afterward run at capacity three shifts a day and handled the ore from all the Rialto mines. The second incident was the loss by fire of the Federal Gordon central mill in March, causing a shut-down of the five Federal Mining & Smelting Co. mines in Oklahoma (as well as the two in Kansas); two of the Oklahoma mines remained idle the rest of the year, but the others were reopened in June and shipped ore to Eagle-Picher mills. The third incident was the flooding May 18 of several large mines in the Cardin area by surface waters overflowing from Tar Creek and entering the mines through a caved shaft; pumping out required about 3 weeks.

Mine shipments of lead and zinc in Oklahoma, 1939–43

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	36, 422	$2, 189, 077	258, 214	$8, 937, 554	27, 720	$2, 605, 680	140, 379	$14, 599, 416
1940	27, 913	1, 656, 497	300, 984	12, 672, 186	21, 240	2, 124, 000	162, 935	20, 529, 810
1941	32, 628	2, 202, 876	307, 207	15, 427, 235	25, 021	2, 852, 394	166, 602	24, 990, 300
1942	29, 794	2, 985, 285	272, 209	19, 163, 622	22, 806	3, 056, 004	146, 510	27, 250, 860
1943	26, 423	3, 208, 885	[2] 213, 195	21, 251, 796	19, 733	2, 959, 950	114, 085	24, 642, 360

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

[2] Includes 58 tons of zinc carbonate averaging 31.03 percent zinc.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1942–43

	1942		1943	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled short tons	5, 012, 485	7, 785, 938	4, 779, 407	8, 880, 784
Total concentrates produced:				
Galena do	29, 371	423	26, 048	375
Sphalerite do	226, 302	45, 907	[1] 169, 380	43, 815
Ratio of concentrates to ore, etc.:				
Lead percent	0. 59	0. 005	0. 55	0. 004
Zinc do	4. 51	. 59	3. 54	. 49
Metal content of ore, etc.: [2]				
Lead do	. 46	. 003	. 42	. 002
Zinc do	2. 71	. 34	2. 12	. 29
Average lead content of galena concentrates do	78. 43	55. 08	76. 59	49. 07
Average zinc content of zinc concentrates do	60. 11	58. 25	59. 76	58. 28
Average value per ton:				
Galena concentrates	$100. 52	$77. 86	$122. 26	$64. 55
Zinc concentrates	68. 54	79. 59	100. 76	95. 51

[1] Includes 58 tons of carbonate averaging 31.03 percent zinc.

[2] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

The Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin treated 3,762,266 tons of crude ore in 1943, of which 2,662,101 tons (71 percent) came from Oklahoma mines, compared with 3,599,087 tons in 1942, of which 2,905,220 tons (81 percent) came from Oklahoma. The principal Eagle-Picher mines in Oklahoma shipping to the mill were: Blue Goose mines, Crystal-Central, Goodeagle mines, Eagle-Picher Gordon No. 2, Grace Walker mines, Hum-bah-wat-tah mines, John Beaver No. 2, Netta, Niday No. 1, See Sah, and Southside mines; other large Oklahoma shippers to the mill were: Davis Big Chief Mining Co. (Skelton, Imbeau, Big Chief No. 3), M. & M. Mining Co. (Piokee, White, La Salle, Swift), Cameron & Henderson (Admiralty No. 2), F. W. Evans (Craig, Shorthorn), Mahutska Mining Co. (Acme-Blackhawk, Jeff City), Carpenter Mining Co. (Oko, New York), Lula Bell Mining Co. (Anna Beaver), and American Development Co. (Hunt). The Eagle-Picher 2,400-ton Bird Dog mill was reopened in February and served about 25 company and outside mines for various periods until November 1, when it began treating only ore from the Oronogo Circle open-pit mine in Missouri, other ores having been diverted to the Central mill.

ing Co. No. 1 mill handled custom ore from the M. & W. Mining Co. Brewster-Huttig and Ninety-Six Brewster mines, Dobson No. 4 mine, Pelican, Santa Fe, and others. The Mission mill received custom ore from various mines, including the Beck Mining Co. Muskogee, Kansas Explorations Lotson, and Mineral Products Swalley (in Kansas). The Guaranty mill was reconditioned by the Mutual Mining & Development Co. and operated as a custom plant about 2 months, mostly on ore from the Mary C. mine. The mine mills of the Jane E. Mining Co. (Scott mine), Kansas Explorations, Inc. (Ritz), Lawyers Lead & Zinc Co., Lula Bell Mining Co. (Farmington), and Weidman Mining Co. (Woodchuck and Townsite) treated company ore. Evans Wallower, Inc., ran its No. 7 mill on company mine dirt and its No. 4 mill on old tailings and some mine dirt. The St. Louis No. 4 mill operated one shift daily on mine dirt and ran an extra shift to remill old tailings on the property. The Romo mill was operated by the Romo Mining Co. on custom ore from the Craig lease until April 1, when the Romo mill, mining leases, and mine equipment were sold to Cameron & Henderson, who continued to mill the custom ore and also milled company ore from the reopened Nevins and Vallier mines at Lincolnville.

The United Zinc Smelting Corporation made an increased output of concentrates in 1943 from its Royal group of mines and mill; the mill treated ore, from the five company-operated shafts, and custom ore, mostly from the Dixie R (Lavrion) and Childress-Heggam mines. During the year the company began developing the Park Walton property 8 miles west of Picher. Drilling in the past on this and other properties in the Melrose area had not shown enough mineralization on a single property to justify the expense of unwatering the large area that would have to be drained before a shaft could be sunk. Therefore the Bureau of Mines and the Defense Plant Corporation participated in the Park Walton development; the Bureau unwatered the property through three large drill holes, and the Defense Plant Corporation advanced funds. Development to the end of the year consisted of a 349-foot shaft and about 125 feet of drifting on the 310-foot level. A test-mill run of the ore early in 1944 gave favorable results, and the company began sinking another shaft and preparing to build a mill.

All the large tailing mills in Oklahoma that were active in 1942 continued running throughout 1943; they comprised the Atlas, Big Chief, Britt & Britt, C. G. & C., Cardin Nos. 2 and 3, Semple (Martin), Tri-State Zinc Ottawa and Sooner, and Western.

From the Davis zinc district in Murray County, idle since 1917, the Arbuckle Mining Co. shipped 209 tons of ore in 1943 to a custom mill in the Tri-State district for a test run; the ore came from open pits on the old Sober-Hope property.

WISCONSIN

Lafayette, Iowa, and Grant Counties in Wisconsin contain the greater part of the Upper Mississippi Valley lead and zinc region, which extends from Wisconsin into Northern Illinois and Iowa; the

Iowa part has made no production since 1917. Activity in mining in the Wisconsin and Northern Illinois parts was stimulated by Government premiums paid for overquota production in 1942 and 1943. The total output of finished (smelting-grade) zinc concentrates increased from 20,601 tons in 1942 to 28,768 tons in 1943 and lead concentrates from 1,289 to 1,430 tons. The principal producer of finished concentrates continued to be the Vinegar Hill Zinc Co., which operated its custom mill near Cuba City on crude ore and zinc-iron-lead rougher jig concentrates purchased from operators throughout the active areas. The finished lead and zinc concentrates produced in 1943 were shipped to smelters outside the State, and the iron concentrates were used to make sulfuric acid in the company plant adjoining the mill. Besides the crude ore treated in 1943, the company bought about 26,000 tons for the Metals Reserve Co. stock pile; this ore is not included in the production for 1943 shown in the tables of this chapter but will be credited to that for the year in which the ore is reduced to concentrates of smelting grade.

Shipments to the mill from Northern Illinois in 1943 amounted to 14,006 tons of crude ore and rougher jig concentrates, averaging 10.29 percent zinc and 0.84 percent lead, of which a calculated 12,699 tons (including all the rougher jig concentrates) were reduced to finished concentrates during the year and yielded 1,152 tons of recoverable zinc and 74 tons of lead. The only other output from Northern Illinois was 10 tons of lead contained in concentrates sold to local buyers. The Wisconsin output, which includes finished concentrates produced at other flotation mills, is given in the tables that follow.

Shippers of Wisconsin rougher jig concentrates to the Vinegar Hill mill comprised the C. F. & H. Mining Co. (Mulcahy mine), Coughlin Mining Co. and its successor the Lucky Hit Mining Co. (Coughlin mine), Four S. & B. Mining Co., Liberty Mining Co., Little Benny Mining Co. (Monroe mine), New Birkett Mining Co. (also shipped crude ore), W. B. Baggaley (Kittoe tailing mill; also crude ore from the Rundell mine), and Wipet Mining Co. (Winskell concentrates and crude ore). The Little Benny Mining Co. also produced some finished concentrates in the company flotation mill erected during the year. The other principal Wisconsin shippers of crude ore to the Vinegar Hill mill were Baker & Deutman (Cleveland mine), Carter & Meloy (Leadmine), Cuba Mining Co. (B. A. T., Mulcahy No. 2), Curwin Mining Co., Deuce Mining Co., Gill Bros. (James), Meloy & Baker (Hoskins, Martin), P. M. Mining Co., Piquette Mining Co. (Trego), Roland J. Teske (McCabe), Thompson Mining Co., and Van Gorden Mining Co.

The Dodgeville Mining Co. operated its leased group of Dodgeville city lots and 150-ton jig and 50-ton flotation mill throughout 1943. Shortage of labor prevented capacity output. W. E. Faithorn operated his 600-ton jig and flotation mill at the Champion property at New Diggings on tailings from June through December. The Chestnut Hill Zinc Co. built a 200-ton table- and flotation-concentration mill at the Field property near Shullsburg and ran it on old tailings from July through December. The Bureau of Mines continued to make examinations and do sampling and exploratory drilling to assist zinc mine owners and operators in bringing their mines into production and to develop ore reserves for future need. Properties drilled included the Bickford at Mifflin; Coker at Livingston; Coughlin, Galena Level, and Winskell near Shullsburg; Crawford at Hazel Green; Homestead and Piquette near Platteville; McIlhon near Mineral Point; and Vial near Linden.

Mine production of lead and zinc in Wisconsin, 1939–43 [1]

Year	Lead concentrates		Zinc concentrates (sphalerite)		Metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	567	$29,327	10,169	$355,915	388	$36,472	5,904	$614,016
1940	621	34,852	10,875	447,396	445	44,500	5,770	727,020
1941	1,639	111,014	11,685	594,323	1,225	139,650	6,238	935,700
1942	1,092	[3] 104,896	17,449	[3] 1,028,828	775	103,850	9,426	1,753,236
1943	1,307	[3] 111,360	26,632	[3] 1,624,858	920	138,000	14,387	3,107,592

[1] Most of the ore mined in Wisconsin from 1939–43 was first treated in gravity-concentration mills producing bulk concentrates which were re-treated by flotation.

[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ores and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

[3] Most of the finished zinc concentrates and part of the lead concentrates produced in Wisconsin in 1942–43 came from a custom mill treating purchased crude ores and low-grade bulk concentrates on which premium payments had been made previously to mine operators; therefore, the value of these concentrates is calculated at market prices. Premium payments not reflected in the value of the finished concentrates amounted to about $399,000 in 1942 and $1,059,000 in 1943 for zinc and $18,500 and $40,600, respectively, for lead; part of these payments, however, were for ore which was stock-piled.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Wisconsin, 1942–43

	1942		1943	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore, etc., milled .... short tons..	208,032	93,642	413,876	184,146
Total concentrates produced: [1]				
Lead .... do....	1,092	....	1,306	1
Zinc .... do....	16,543	906	24,922	1, 10
Ratio of concentrates to ore, etc.: [2]				
Lead .... percent..	0.52	....	0.32	....
Zinc .... do....	7.95	0.97	6.03	1.27
Metal content of ore, etc.: [3]				
Lead .... do....	.39	....	.23	....
Zinc .... do....	4.78	0.57	3.62	.75
Average lead content of galena concentrates .... do....	74.27	....	71.77	69.58
Average zinc content of sphalerite concentrates .. do....	60.12	58.83	60.09	58.95
Average value per ton: [4]				
Galena concentrates	$96.06	....	$85.21	$71.00
Sphalerite concentrates	58.07	$75.22	58.86	92.36

[1] Most of the ore mined in Wisconsin in 1942–43 was first treated in gravity-concentration mills producing bulk concentrates which were re-treated by flotation.

[2] Percentage represents finished flotation concentrates.

[3] Percentages represent metal content of the ore insofar as it is recovered in the concentrates.

[4] Most of the finished zinc concentrates and part of the lead concentrates produced in Wisconsin in 1942–43 came from a custom mill treating purchased crude ores and low-grade bulk concentrates on which premium payments had been made previously to mine operators; therefore, the value of these concentrates is calculated at market prices.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO

(MINE REPORT)

By Chas. W. Henderson, R. H. Mote, and R. V. Cushman

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SUMMARY

Colorado mines yielded gold, silver, copper, lead, and zinc valued, in terms of recovered metals, at $19,205,415 in 1943 compared with $19,896,623 in 1942. Gold and silver together represented 35 percent of the total value in 1943 and 58 percent in 1942. Gold production in 1943 was the lowest in any year since 1876; production decreased 49 percent from 1942. The quantity of silver and copper produced decreased 14 and 7 percent, respectively; lead increased 19 percent and zinc 37 percent. The number of producing lode mines decreased from 311 in 1942 to 235 in 1943; the number of placer mines decreased from 68 to 17.

Premium payments for overquota production of copper, lead, and zinc were in force throughout 1943. Early in the year the Metals Reserve Co. issued a revised scale of premium payments and established three premium-price classes for zinc, designated A, B, and C. Because of the close affinity of lead and zinc in most ore bodies, lead was included in this plan; no change in premium-price set-up was announced for copper. Lead received one additional premium for the B class of 2¾ cents a pound above the 6½-cent-a-pound ceiling price and 2¾-cent-a-pound premium in effect throughout most of 1942. Zinc received two additional premiums of 2¾ cents each for the B and C classes above the 8¼-cent-a-pound ceiling price and 2¾-cent-a-pound A premium offered in 1942. On October 27, 1943, the War Production Board, in a sudden about-face of Government policy regarding subsidy of base-metal mining, announced that premiums in the B and C level for zinc would be denied mines not already operating and mines having a low productivity of zinc; premiums in the B level had already been denied lead mines. Establishing a future policy, the War Production Board also announced that the Government would not finance any new zinc projects. On November 9, 1943, the Board stated that no more applications for the special copper premium price under the plan effective since May 1, 1943, would be received after December 31, 1943. These actions of October 27 were prompted by increased mineral production, a greater need for labor than for large stock piles of ore of no immediate use, and revised metal requirements of the armed service.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of January 31, 1934. Treasury legal coinage value of gold from January 18, 1837, to January 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Annual figures for the 5 years ended with 1943 and total production from 1858 are given in the table that follows. To the end of 1941 Colorado had produced more silver than any other State, but with the decreased output in 1942 and 1943 in Colorado Montana ranked first.

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1939–43, and total, 1858–1943, in terms of recovered metals

Year	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	758	583	1,914,593	366,852	$12,839,820	8,496,488	$5,767,313
1940	691	439	2,157,765	367,336	12,856,760	9,710,709	6,905,393
1941	579	324	2,222,786	380,029	13,301,015	7,301,697	5,192,318
1942	311	68	1,797,386	268,627	9,401,945	3,096,211	2,201,750
1943	235	17	1,631,318	137,558	4,814,530	2,664,142	1,894,501
1858–1943	-------	-------	(1)	38,702,940	848,479,864	723,710,917	562,577,427

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	26,430,000	$2,748,720	16,444,000	$772,868	3,660,000	$190,320	$22,319,041
1940	24,304,000	2,746,352	22,952,000	1,147,600	10,120,000	637,560	24,293,665
1941	13,496,000	1,592,528	25,148,000	1,433,436	31,444,000	2,358,300	23,877,597
1942	2,204,000	266,684	30,362,000	2,034,254	64,430,000	5,991,990	19,896,623
1943	2,056,000	267,280	36,064,000	2,704,800	88,188,000	9,524,304	19,205,415
1858–1943	[2] 246,424	65,033,163	[2] 2,410,104	229,434,767	[2] 1,227,323	177,102,990	1,882,628,211

[1] Figures not available.

[2] Short tons.

Gold and silver produced at placer mines in Colorado, 1939–43, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1939	2,535	498	15	1	10,631	2,436	1,950	178	4,688	1,012	19,819	4,125
1940	1,822	360	-------	-------	10,203	2,210	-------	-------	4,975	1,068	17,000	3,638
1941	1,886	402	-------	-------	13,052	2,580	4,817	553	10,622	2,152	30,377	5,687
1942	1,802	335	-------	-------	119	9	6,173	945	14,523	2,913	22,617	4,202
1943	521	90	-------	-------	-------	-------	-------	-------	-------	-------	521	90

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

Gold.—The mine production of recovered gold in Colorado was 137,558 fine ounces in 1943 compared with 268,627 ounces in 1942. Dry and siliceous ores yielded 86 percent of the State total gold; zinc-lead ore, 12 percent; and copper, lead, lead-copper, and zinc ores and small placer operations, 2 percent.

Silver.—The mine production of recovered silver in Colorado was 2,664,142 fine ounces in 1943 compared with 3,096,211 ounces in 1942. Dry and siliceous ores yielded 61 percent of the State total silver; zinc-lead ore, 34 percent; lead ore, nearly 5 percent; and copper, lead-copper, and zinc ores and small placer mines, nearly 1 percent.

Copper.—The output of recovered copper from mines in Colorado in 1943 was 2,056,000 pounds compared with 2,204,000 pounds in 1942. Dry and siliceous ores yielded 56 percent of the State total copper; zinc-lead ores, 32 percent; copper ore, 9 percent; and lead, lead-copper, and zinc ores, 3 percent.

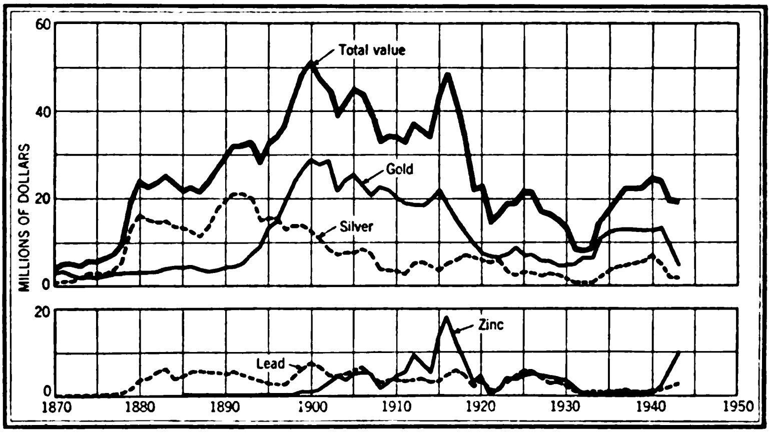

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1943. The value of copper has been less than $2,000,000 annually, except in a few years.

Lead.—The mine production of recovered lead in Colorado was 36,064,000 pounds in 1943 compared with 30,362,000 pounds in 1942. Zinc-lead ore yielded nearly 63 percent of the State total lead; dry and siliceous ores, 30 percent; lead ore, nearly 7 percent; and copper, lead-copper, and zinc ores, 0.1 percent.

Zinc.—The output of recovered zinc from mines in Colorado in 1943, largest since 1918, increased 37 percent in quantity over 1942. Zinc and zinc-lead ores yielded 95 percent of the State total zinc, and dry and siliceous ores nearly 5 percent. The principal zinc-producing districts in 1943, in order of output, were: Red Cliff (Battle Mountain), California (Leadville), Pioneer (Rico), Upper San Miguel (Telluride), Ten Mile (Kokomo, Robinson), Animas, Buckskin, Kerber Creek (Bonanza), Cotopaxi, Tomichi, Sneffels, Breckenridge, Griffith, and Roaring Fork (Aspen).

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Adams		2	145	$5,075	20	$14
Boulder	19		2,231	78,085	12,105	8,608
Chaffee	3	1	156	5,460	4,472	3,180
Clear Creek	32	1	4,528	158,480	197,685	140,576
Custer	6		131	4,585	11,693	8,315
Dolores	2		127	4,445	145,021	103,126
Eagle	1		421	14,735	176,116	125,238
Fremont	2		78	2,730	779	554
Gilpin	18	4	1,382	48,370	22,112	15,724
Grand	1				277	197
Gunnison	5		43	1,505	25,207	17,925
Hinsdale	1		34	1,190	9,329	6,634
Jefferson	1	4	138	4,830	55	39
Lake	24		23,150	810,250	379,513	269,876
La Plata	3		250	8,750	578	411
Mineral	7		465	16,275	630,952	448,677
Montrose	1	1	18	630	5,272	3,749
Ouray	18		4,937	172,795	91,679	65,194
Park	9	2	8,434	295,190	21,597	15,358
Pitkin	4		2	70	302,386	215,030
Rio Grande	1		3,287	115,045	1,402	997
Routt	1		2	70	495	352
Saguache	10		216	7,560	36,464	25,930
San Juan	19		21,217	742,595	327,098	232,603
San Miguel	4		20,204	707,140	210,763	149,876
Summit	21	2	857	29,995	43,529	30,954
Teller	22		45,105	1,578,675	7,543	5,364
	235	17	137,558	4,814,530	2,664,142	1,894,501
Total, 1942	311	68	268,627	9,401,945	3,096,211	2,201,750

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$5,089
Boulder	20,000	$2,600	113,000	$8,475	22,000	$2,376	100,144
Chaffee	1,400	182	331,000	24,825	44,000	4,752	38,399
Clear Creek	47,000	6,110	833,400	62,505	666,000	71,928	439,599
Custer	300	39	181,000	13,575	272,000	29,376	55,890
Dolores	144,500	18,785	5,132,000	384,900	7,304,000	788,832	1,300,088
Eagle	229,000	29,770	3,522,000	264,150	57,709,000	6,232,572	6,666,465
Fremont	27,200	3,536	70,000	5,250	947,000	102,276	114,346
Gilpin	95,200	12,376	237,000	17,775	131,000	14,148	108,393
Grand							197
Gunnison	16,000	2,080	639,000	47,925	706,000	76,248	145,683
Hinsdale	9,700	1,261	381,000	28,575	33,000	3,564	41,224
Jefferson	500	65	200	15	2,000	216	5,165
Lake	282,000	36,660	9,901,000	742,575	11,023,000	1,190,484	3,049,845
La Plata	1,100	143	3,400	255			9,559
Mineral	101,000	13,130	1,155,000	86,625	13,000	1,404	566,111
Montrose	129,000	16,770					21,149
Ouray	144,000	18,720	1,079,000	80,925	654,000	70,632	408,266
Park	68,000	8,840	400,000	30,000	1,133,000	122,364	471,752
Pitkin	2,600	338	686,000	51,450	408,000	44,064	310,952
Rio Grande	17,000	2,210					118,252
Routt	3,000	390	11,000	825	64,000	6,912	8,549
Saguache	50,500	6,565	796,000	59,700	891,000	96,228	195,983
San Juan	498,000	64,740	5,397,000	404,775	1,004,000	108,432	1,553,145
San Miguel	142,000	18,460	4,149,000	311,175	2,426,000	262,008	1,448,659
Summit	27,000	3,510	1,047,000	78,525	2,736,000	295,488	438,472
Teller							1,584,039
	2,056,000	267,280	36,064,000	2,704,800	88,188,000	9,524,304	19,205,415
Total, 1942	2,204,000	266,684	30,362,000	2,034,254	64,430,000	5,991,990	19,896,623

Ore sold or treated and gold and silver produced at lode mines in Colorado in 1943, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Boulder	19,749	2,231	12,105
Chaffee	1,404	28	4,455
Clear Creek	38,879	4,525	197,685
Custer	4,460	131	11,693
Dolores	34,055	127	145,021
Eagle	258,879	421	176,116
Fremont	4,860	78	779
Gilpin	6,873	1,365	22,109
Grand	3	------	277
Gunnison	4,184	43	25,207
Hinsdale	8,250	34	9,329
Jefferson	14	1	31
Lake	458,702	23,150	379,513
La Plata	42	250	578
Mineral	30,290	465	630,952
Montrose	2,044	15	5,271
Ouray	36,523	4,937	91,679
Park	68,053	8,420	21,593
Pitkin	17,746	2	302,386
Rio Grande	3,350	3,287	1,402
Routt	355	2	495
Saguache	11,434	216	36,464
San Juan	202,100	21,217	327,098
San Miguel	162,556	20,204	210,763
Summit	29,605	783	43,508
Teller	226,908	45,105	7,543
	1,631,318	137,037	2,664,052
Total, 1942	1,797,386	246,010	3,092,009

Gold and silver produced at placer mines in Colorado in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Dredges						Total	
			Dry-land [1]		Dragline floating		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Adams	145	20	------	------	------	------	------	------	145	20
Chaffee	128	17	------	------	------	------	------	------	128	17
Clear Creek	3	------	------	------	------	------	------	------	3	------
Gilpin	17	3	------	------	------	------	------	------	17	3
Jefferson	137	24	------	------	------	------	------	------	137	24
Montrose	3	1	------	------	------	------	------	------	3	1
Park	14	4	------	------	------	------	------	------	14	4
Summit	74	21	------	------	------	------	------	------	74	21
	521	90	------	------	------	------	------	------	521	90
Total, 1942	1,802	335	119	9	6,173	945	14,523	2,913	22,617	4,202

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

Except for the Cripple Creek district, virtually all the ores in Colorado districts—although chiefly valuable for gold and silver—contain some zinc, often discarded. A change in selection of ore and in metallurgy at many of the mines operating in the State in 1943 converted them into producers of zinc concentrates or products containing recoverable zinc. This conversion is shown clearly by comparison of the county and district tables for 1939 and 1943.

A serious labor shortage hampered virtually every mining operation in the State during 1943. The shortage of labor became so acute during the summer months that the Army authorized a plan to release a total of 4,500 soldier-miners from the Ninth Service Command for work in the copper, zinc, and molybdenum mines. This program began August 12, 1943, and approximately 1,000 soldiers were released each week thereafter until the full quota had been exhausted. Of this 4,500, Colorado mines received 269 men. Other factors that had a restraining influence on the mining industry of Colorado were the continuance of certain Government regulations, and of absenteeism at the larger producing mines, which particularly retarded production after paydays.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Colorado in 1943, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	885, 838	113, 936	540, 481	758, 684	7, 575, 505	3, 586, 697
Dry and siliceous gold-silver ore	30, 105	3, 152	112, 726	72, 178	894, 323	----------
Dry and siliceous silver ore	78, 883	625	975. 466	316, 906	2, 362, 600	408, 000
	994, 826	117, 713	1, 628, 673	1, 147, 768	10, 832, 428	3, 994, 697
Copper ore	3, 008	76	12, 107	184, 853	3, 269	----------
Lead ore	15, 291	2, 141	122, 305	29, 738	2, 513, 681	----------
Lead-copper ore	65	8	690	7, 559	8, 005	----------
Zinc ore	4, 378	68	7, 272	26, 533	24, 977	1, 138, 942
Zinc-lead ore	613, 750	17, 031	893, 005	659, 549	22, 681, 640	83, 054, 361
	636, 492	19, 324	1, 035, 379	908, 232	25, 231, 572	84, 193, 303
Total, lode mines	1, 631, 318	137, 037	2, 664, 052	2, 056, 000	36, 064, 000	88, 188, 000
Total, placers	----------	521	90	----------	----------	----------
	1, 631, 318	137, 558	2, 664, 142	2, 056, 000	36, 064, 000	88, 188, 000
Total, 1942	1, 797, 386	268, 627	3, 096, 211	2, 204, 000	30, 362, 000	64, 430, 000

METALLURGIC INDUSTRY

Total ore sold or treated in Colorado was 1,631,318 tons in 1943 compared with 1,797,386 tons in 1942. The quantity of zinc-lead ore sold or treated increased from 577,162 to 613,750 tons; dry and siliceous ores decreased from 1,212,986 to 994,826 tons; and copper ore increased from 208 to 3,008 tons, lead ore from 6,418 to 15,291 tons, and zinc ore from 590 to 4,378 tons.

Direct smelting ore comprised 3 percent of the State total output of ore in 1943 as in 1942. The Arkansas Valley lead bullion-leady copper matte smelter at Leadville purchased most of the gold, silver, and gold-silver-lead-copper ore and concentrates shipped to smelters during the year. Ore treated at concentrating plants comprised 48 percent of the State total output of ore; and ore treated at amalgamation and cyanidation mills, including those with concentration equipment, 49 percent. Of the ore treated at concentrating plants 476,844 tons were zinc-lead ore, 221,033 tons dry gold ore, and 58,821 tons dry silver ore.

The destination and treatment of concentrates and ore produced by operators in the State are discussed in the following review by counties and districts.

Figures for the quantity of gravel handled at the 17 small placer mines worked in 1943 are not available.

Mine production of metals in Colorado in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated [1]	650, 601	27, 670	10, 245			
Ore, concentrates, sands, and slimes cyanided [2]	[3] 280, 441	38, 636	14, 413			
Concentrates smelted	154, 381	66, 108	2, 402, 438	1, 642, 243	32, 508, 705	88, 138, 094
Ore smelted	42, 629	4, 623	236, 956	413, 757	3, 555, 295	49, 906
Placer [1]		521	90			
		137, 558	2, 664, 142	2, 056, 000	36, 064, 000	88, 188, 000
Total, 1942		268, 627	3, 096, 211	2, 204, 000	30, 362, 000	64, 430, 000

[1] Quicksilver used by amalgamation mills was 1,384 pounds. Placer mines used approximately 10 pounds.

[2] Cyanide (in terms of 96 to 98 percent NaCN) used was 332,806 pounds.

[3] Comprises 228,534 tons of sands and slimes from ore first roasted and amalgamated, 50,118 tons of selective-flotation tailings, and 1,789 tons of flotation concentrates.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Colorado in 1943, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	2, 249	1, 070	828	45	168	378		15, 600	22, 000
Chaffee	314	7	37	61	18	378	782	10, 666	39, 358
Clear Creek	23, 374	2, 841	1, 374	815	822	32, 788	10, 371	202, 815	116, 601
Custer	4, 309	38	961	506	92	9, 856	108	144, 883	272, 000
Fremont	4, 860	23	65	1, 230	55	714	27, 200	70, 000	947, 000
Gilpin	2, 900	159	704	362	437	9, 490	10, 256	185, 632	125, 974
Grand	3		26	(1)		251			
Jefferson	14		3	3	1	28	500	200	2, 000
Lake	325, 592	6, 279	6, 381	13, 150	5, 982	144, 245	144, 187	2, 166, 357	2, 675, 398
Ouray	32, 551	3, 165	846	2, 239	1, 662	78, 247	112, 267	733, 131	505, 179
Park	2, 696	135	462	376	334	4, 731	9, 933	64, 931	243, 725
Rio Grande	3, 350	1, 426	36	260	1, 861	1, 366	17, 000		
Saguache	8, 028	49	1, 049	741	121	12, 765	14, 245	275, 954	340, 810
San Juan	393	5	61	113	14	629	1, 913	34, 179	58, 412
San Miguel	144, 592	5, 867	3, 202	15, 603	13, 138	166, 885	109, 786	3, 677, 211	2, 426, 000
Summit	18, 729	137	1, 080	2, 383	425	20, 420	20, 306	823, 697	1, 225, 314
Teller	226, 908	45, 105	7, 543						
	800, 862	66, 306	24, 658	37, 887	25, 130	483, 171	478, 854	8, 405, 256	8, 999, 771
Total, 1942	926, 909	146, 365	29, 108	30, 520	33, 804	421, 240	394, 497	4, 112, 886	1, 515, 874

BY CLASSES OF ORE TREATED

Dry and siliceous gold	660, 771	65, 270	15, 175	27, 402	22, 254	343, 935	344, 369	5, 512, 549	3, 171, 706
Dry and siliceous silver	3		26	(1)		251			
Zinc	3, 298	14	3	1, 006	34	66	20, 600	200	831, 600
Zinc-lead	136, 790	1, 022	9, 454	9, 479	2, 842	138, 919	113, 885	2, 892, 507	4, 996, 465
	800, 862	66, 306	24, 658	37, 887	25, 130	483, 171	478, 854	8, 405, 256	8, 999, 771

[1] Less than ½ ton.

Mine production of metals from concentrating mills in Colorado in 1943, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	16, 948	298	230	10, 062	8, 128	97, 400	....
Clear Creek	15, 376	1, 833	810	161, 453	32, 759	605, 420	531, 877
Dolores	34, 055	12, 094	127	145, 021	144, 500	5, 132, 000	7, 304, 000
Eagle	254, 913	63, 336	231	124, 630	33, 781	3, 499, 559	57, 709, 000
Gilpin	3, 764	704	532	10, 003	71, 119	35, 664	5, 026
Gunnison	3. 974	1, 255	42	21, 804	15, 844	576, 310	706, 000
Hinsdale	8, 250	397	34	9, 329	9, 700	381, 000	33, 000
Lake	106, 092	16, 308	8, 239	137, 846	106, 431	5, 308, 241	8, 319, 860
Mineral	27, 416	2, 354	314	579, 830	97, 241	837, 596	13, 000
Ouray	3, 270	497	51	10, 824	21, 969	296, 177	148, 821
Park	65, 061	4, 051	7, 813	15, 367	58, 067	323, 590	889, 275
Pitkin	15, 122	1. 194	2	290, 898	2, 600	627, 690	408, 000
Routt	355	85	2	495	3, 000	11, 000	64, 000
Saguache	3, 025	918	31	17, 375	25, 303	395, 240	550, 190
San Juan	201, 527	7, 651	21, 183	324, 889	494, 512	5, 298, 603	945, 588
San Miguel	17, 964	1, 505	1, 199	40, 676	32, 214	471, 789	....
Summit	10, 715	2, 014	138	18, 765	6, 221	206, 170	1, 510, 686
	787, 827	116, 494	40, 978	1, 919, 267	1, 163, 389	24, 103, 449	79, 138, 323
Total, 1942	822, 304	110, 070	57, 415	2, 021, 864	1, 073, 256	23, 688, 039	62, 358, 338

BY CLASSES OF ORE TREATED

	Ore treated (short tons)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	221, 033	6, 447	24, 312	171, 550	390, 334	1, 904, 887	414, 991
Dry and siliceous gold-silver	28, 684	2, 158	8, 074	107, 639	71, 469	825, 229	....
Dry and siliceous silver	58, 821	3, 766	328	882, 118	106, 184	1, 555, 211	408, 000
Copper	921	206	48	5, 602	46, 816	2, 398	....
Lead	546	92	67	3, 419	1, 960	31, 637	....
Zinc	978	343	16	5, 577	4, 400	15, 863	279, 600
Zinc-lead	476, 844	103, 482	13, 133	743, 362	542, 226	19, 768, 224	78, 035, 732
	787, 827	116, 494	40, 978	1, 919, 267	1, 163, 389	24, 103, 449	79, 138, 323

Gross metal content of concentrates produced from ores mined in Colorado in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (wet assay) (pounds)	Lead (wet assay) (pounds)	Zinc (pounds)
Dry gold	4, 539	7, 872	26, 445	75, 379	398, 340	420, 876
Dry gold-silver	158	123	2, 589	5, 927	8, 469	....
Dry silver	5	2	434	....	287	....
Copper	843	2, 277	8, 399	94, 757	4, 229	....
Lead	47, 419	41, 692	1, 913, 948	819, 576	31, 402, 211	4, 098, 003
Lead-copper	2, 834	9, 925	192, 464	459, 679	1, 656, 718	262, 867
Total to copper and lead plants	55, 798	61, 891	2, 144, 279	1, 455, 318	33, 470, 254	4, 781, 746
Zinc	96, 149	3, 463	255, 935	475, 364	2, 270, 160	92, 485, 366
Zinc-lead	2, 434	1, 783	79, 840	135, 005	826, 465	905, 723
Total to zinc plants	98, 583	5, 246	335, 775	610, 369	3, 096, 625	93, 391, 089
	154, 381	67, 137	2, 480, 054	2, 065, 687	36, 566, 879	98, 172, 835
Total, 1942	140, 590	91, 700	2, 486, 643	1, 806, 560	31, 020, 943	76, 650, 345

Mine production of metals from Colorado concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	343	398	10,440	8,128	113,000	22,000
Chaffee	61	18	378	782	10,666	39,358
Clear Creek	2,648	1,632	194,241	43,130	808,235	648,478
Custer	506	92	9,856	108	144,883	272,000
Dolores	12,094	127	145,021	144,500	5,132,000	7,304,000
Eagle	63,336	231	124,630	33,781	3,499,559	57,709,000
Fremont	1,230	55	714	27,200	70,000	947,000
Gilpin	1,066	969	19,493	81,375	221,296	131,000
Grand	(1)		251			
Gunnison	1,255	42	21,804	15,844	576,310	706,000
Hinsdale	397	34	9,329	9,700	381,000	33,000
Jefferson	3	1	28	500	200	2,000
Lake	29,458	14,221	282,091	250,618	7,474,598	10,995,258
Mineral	2,354	314	579,830	97,241	837,596	13,000
Ouray	2,736	1,713	89,071	134,236	1,029,308	654,000
Park	4,427	8,147	20,098	68,000	388,521	1,133,000
Pitkin	1,194	2	290,898	2,600	627,690	408,000
Rio Grande	260	1,861	1,366	17,000		
Routt	85	2	495	3,000	11,000	64,000
Saguache	1,659	152	30,140	39,548	671,194	891,000
San Juan	7,764	21,197	325,518	496,425	5,332,782	1,004,000
San Miguel	17,108	14,337	207,561	142,000	4,149,000	2,426,000
Summit	4,397	563	39,185	26,527	1,029,867	2,736,000
	154,381	66,108	2,402,438	1,642,243	32,508,705	88,138,094
Total, 1942	140,590	91,219	2,446,104	1,467,753	27,800,925	63,874,212

BY CLASSES OF CONCENTRATES SMELTED

Dry gold	4,539	7,872	26,445	60,264	358,316	
Dry gold-silver	158	123	2,589	4,742	7,622	
Dry silver	5	2	400		253	
Copper	843	2,277	8,399	85,980	2,607	
Lead	47,419	41,692	1,913,948	642,904	28,359,882	
Lead-copper	2,834	9,925	192,464	365,639	1,493,532	
Total to copper and lead plants	55,798	61,891	2,144,245	1,159,529	30,222,212	
Zinc	96,149	2,434	178,353	367,860	1,472,039	87,575,656
Zinc-lead	2,434	1,783	79,840	114,854	814,454	562,438
Total to zinc plants	98,583	4,217	258,193	482,714	2,286,493	88,138,094
	154,381	66,108	2,402,438	1,642,243	32,508,705	88,138,094

[1] Less than ½ ton.

Gross metal content of Colorado crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore (short tons)	Gross metal content: Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	4,034	2,100	9,821	30,024	176,248	....
Dry and siliceous gold-silver	1,421	78	5,087	886	76,770	....
Dry and siliceous silver	20,059	297	93,104	238,964	903,617	1,632
Copper	2,087	28	6,505	142,122	1,452	....
Lead	14,745	2,074	118,886	35,030	2,753,694	126,044
Lead-copper	65	8	690	11,364	8,502	....
Total to copper and lead plants	42,411	4,585	234,093	458,390	3,920,283	127,676
Zinc	102	4	1,626	1,804	9,041	44,745
Zinc-lead	116	34	1,270	3,882	21,206	35,749
Total to zinc plants	218	38	2,896	5,686	30,247	80,494
	42,629	4,623	236,989	464,076	3,950,530	208,170
Total, 1942	48,173	8,426	617,064	818,156	2,883,677	996,306

Mine production of metals from Colorado crude ore shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	552	763	837	11,872	....	....
Chaffee	1,090	3	4,040	618	320,334	4,642
Clear Creek	129	52	2,070	3,870	25,165	17,522
Custer	151	1	876	192	36,117	....
Eagle	3,966	190	51,486	195,219	22,441	....
Gilpin	209	237	1,912	13,825	15,704	....
Gunnison	210	1	3,403	156	62,690	....
Lake	27,018	2,650	91,041	31,382	2,426,402	27,742
La Plata	42	250	578	1,100	3,400	....
Mineral	2,874	151	51,122	3,759	317,404	....
Montrose	2,044	15	5,271	129,000	....	....
Ouray	702	59	1,762	9,764	49,692	....
Park	296	138	1,033	....	11,479	....
Pitkin	2,624	....	11,488	....	58,310	....
Saguache	381	15	5,275	10,952	124,806	....
San Juan	180	15	1,519	1,575	64,218	....
Summit	161	83	3,243	473	17,133	....
	42,629	4,623	236,956	413,757	3,555,295	49,906
Total, 1942	48,173	8,426	616,797	736,247	2,561,075	555,788

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	4,034	2,100	9,821	23,981	158,069	....
Dry and siliceous gold-silver	1,421	78	5,087	709	69,094	....
Dry and siliceous silver	20,059	297	93,071	210,722	807,389	....
Copper	2,087	28	6,505	138,037	871	....
Lead	14,745	2,074	118,886	27,778	2,482,044	....
Lead-copper	65	8	690	7,559	8,005	....
Total to copper and lead plants	42,411	4,585	234,060	408,786	3,525,472	....
Zinc	102	4	1,626	1,533	8,914	27,742
Zinc-lead	116	34	1,270	3,438	20,909	22,164
Total to zinc plants	218	38	2,896	4,971	29,823	49,906
	42,629	4,623	236,956	413,757	3,555,295	49,906

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Adams County	---	2	---	---	145	145	---	20	20	---	---	---	$5,089
Boulder County:													
Central	4	---	16,229	61	---	61	3,489	---	3,489	5,400	94,200	---	12,383
Gold Hill	5	---	1,334	457	---	457	433	---	433	---	13,600	19,600	19,440
Grand Island	1	---	150	2	---	2	6,328	---	6,328	800	2,400	---	4,854
Sugar Loaf	5	---	814	732	---	732	730	---	730	---	2,000	2,400	26,548
Ward	4	---	1,222	979	---	979	1,125	---	1,125	13,800	800	---	36,919
Chaffee County:													
Granite	---	1	---	---	128	128	---	17	17	---	---	---	4,492
Monarch	3	---	1,404	28	---	28	4,455	---	4,455	1,400	331,000	44,000	33,907
Clear Creek County:													
Argentine	5	---	754	53	---	53	1,838	---	1,838	1,500	88,600	38,000	11,106
Empire	2	---	10,651	2,500	---	2,500	758	---	758	---	4,200	2,300	88,602
Griffith	7	---	9,018	63	---	63	145,243	---	145,243	6,200	335,400	448,000	179,884
Idaho Springs	13	1	6,664	857	3	860	22,576	---	22,576	34,500	231,400	153,000	84,518
Montana	2	---	2,875	34	---	34	19,613	---	19,613	1,600	71,600	3,000	21,039
Trail Creek	3	---	8,917	1,018	---	1,018	7,657	---	7,657	3,200	102,200	21,700	51,500
Custer County:													
Hardscrabble	5	---	4,440	131	---	131	11,693	---	11,693	300	161,400	272,000	54,420
Ilse	1	---	20	---	---	---	---	---	---	---	19,600	---	1,470
Dolores County: Pioneer (Rico)	2	---	34,055	127	---	127	145,021	---	145,021	144,500	5,132,000	7,304,000	1,300,088
Eagle County: Red Cliff	1	---	258,879	421	---	421	176,116	---	176,116	229,000	3,522,000	57,709,000	6,666,465
Fremont County:													
Cotopaxi	1	---	3,284	47	---	47	38	---	38	20,100	---	829,600	93,882
Grape Creek	1	---	1,576	31	---	31	741	---	741	7,100	70,000	117,400	20,464
Gilpin County: Southern	18	4	6,873	1,365	17	1,382	22,109	3	22,112	95,200	237,000	131,000	108,393
Grand County	1	---	3	---	---	---	277	---	277	---	---	---	197
Gunnison County:													
Elk Mountain	1	---	21	1	---	1	169	---	169	---	2,400	3,400	702
Quartz Creek	1	---	3	---	---	---	305	---	305	---	1,200	---	307
Taylor Park	2	---	219	2	---	2	3,136	---	3,136	500	67,800	16,600	9,243
Tomichi	1	---	3,941	40	---	40	21,597	---	21,597	15,500	567,600	686,000	135,431
Hinsdale County: Galena	1	---	8,250	34	---	34	9,329	---	9,329	9,700	381,000	33,000	41,224
Jefferson County	1	4	14	1	137	138	31	24	55	500	200	2,000	5,165
Lake County: California (Leadville)	24	---	458,702	23,150	---	23,150	379,513	---	379,513	282,000	9,901,000	11,023,000	3,049,845
La Plata County: California	3	---	42	250	---	250	578	---	578	1,100	3,400	---	9,559
Mineral County: Creede	7	---	30,290	465	---	465	630,952	---	630,952	101,000	1,155,000	13,000	566,111
Montrose County: La Sal and San Miguel River	1	1	2,044	15	3	18	5,271	1	5,272	129,000	---	---	21,149

Ouray County:													
Red Mountain	7	------	1, 619	37	------	37	5, 393	------	5, 393	27, 600	170, 000	106, 000	32, 916
Sneffels	7	------	32, 860	4, 834	------	4, 834	80, 924	------	80, 924	112, 500	749, 000	511, 000	352, 724
Uncompahgre	4	------	2, 044	66	------	66	5, 362	------	5, 362	3, 900	160, 000	37, 000	22, 626
Park County:													
Alma Placers	------	1	------	------	6	6	------	1	1	------	------	------	211
Buckskin	3	------	6, 203	1, 762	------	1, 762	11, 676	------	11, 676	42, 000	163, 000	941, 900	189, 383
Consolidated Montgomery	2	------	996	359	------	359	2, 416	------	2, 416	4, 400	15, 000	21, 100	18, 259
Fairplay	------	1	------	------	8	8	------	3	3	------	------	------	282
Mosquito	3	------	60, 741	6, 298	------	6, 298	7, 501	------	7, 501	21, 200	222, 000	161, 400	262, 601
Pulver	1	------	113	1	------	1	------	------	------	400	------	8, 600	1, 016
Pitkin County: Roaring Fork	4	------	17, 746	2	------	2	302, 386	------	302, 386	2, 600	686, 000	408, 000	310, 952
Rio Grande County: Summitville	1	------	3, 350	3, 287	------	3, 287	1, 402	------	1, 402	17, 000	------	------	118, 252
Routt County	1	------	355	2	------	2	495	------	495	3, 000	11, 000	64, 000	8, 549
Saguache County: Kerber Creek	10	------	11, 434	216	------	216	36, 464	------	36, 464	50, 500	796, 000	891, 000	195, 983
San Juan County:													
Animas	11	------	201, 295	21, 188	------	21, 188	323, 706	------	323, 706	492, 600	5. 313, 800	948, 500	1, 536, 782
Eureka	7	------	741	26	------	26	3, 084	------	3, 084	4, 900	78, 800	53, 000	15, 374
Ice Lake Basin	1	------	64	3	------	3	308	------	308	500	4, 400	2, 500	989
San Miguel County: Upper San Miguel	4	------	162, 556	20, 204	------	20, 204	210, 763	------	210, 763	142, 000	4, 149, 000	2, 426, 000	1, 448, 659
Summit County:													
Breckenridge	6	2	11, 469	355	74	429	4, 244	21	4, 265	16, 200	472, 200	461, 000	105, 357
Green Mountain	2	------	512	13	------	13	5, 116	------	5, 116	1, 000	5, 800	207, 000	27, 014
Montezuma	6	------	1, 360	13	------	13	5, 985	------	5, 985	2, 100	118, 000	126, 500	27, 496
Ten Mile	7	------	16, 264	402	------	402	28, 163	------	28, 163	7, 700	451, 000	1, 941, 500	278, 605
Teller County: Cripple Creek	22	------	226, 908	45, 105	------	45, 105	7, 543	------	7, 543	------	------	------	1, 584, 039
Total Colorado	235	17	1, 631, 318	137, 037	521	137, 558	2, 664, 052	90	2, 664, 142	2, 056, 000	36, 064, 000	88, 188, 000	19, 205, 415

ADAMS COUNTY

Gold and silver were recovered as byproducts during 1943 from the gravel-washing plant of the Brannan Sand & Gravel Co. on Clear Creek north of Denver.

BOULDER COUNTY

Central (Jamestown) district.—All of the copper and lead and most of the gold and silver produced in the Central district in 1943 were recovered as byproducts of fluorspar mining. The General Chemical Co. mined fluorspar from its claims near Jamestown throughout the year and also shipped a small quantity of gold ore from surface dumps on the Invincible claim to the Golden Cycle mill during the first part of the year. The Argo, Brown Spar, and Emmett mines were operated by H. M. Williamson & Son for the production of fluorspar; lead-silver concentrates recovered from the milling of the fluorspar were shipped to the Leadville smelter. Operators on the Black Rose group and the New Rival shipped small lots of gold ore to the Golden Cycle mill.

Gold Hill district.—The production of gold from the Gold Hill district in 1943 decreased 94 percent from 1942. Only 5 mines were in operation compared with 15 in 1942. Lessees worked the Gardner mine, leading producer in 1943, and shipped zinc-lead ore containing 35,798 pounds of zinc, 24,571 pounds of lead, 619 ounces of silver, and 261.46 ounces of gold to the Golden Cycle mill at Colorado Springs. Other mines which shipped ore to the Golden Cycle mill were the Sunshine and Home Sweet Home.

Grand Island district (Nederland).—The only base-metal mine in operation in the Grand Island district in 1943 was the Blue Bird, worked by the Great Western Silver Mines Corporation; lead-silver-gold-copper concentrates were shipped to the Leadville smelter.

Sugar Loaf district.—All the base-metal ore produced from the Sugar Loaf district in 1943 was shipped to the Golden Cycle mill. The Poorman group was operated continuously by lessees until September and again was the largest producer of gold in the district. The largest producer of silver was the Nancy mine, operated throughout the year by the Hard Rock Mining Co. of Boulder. Most of the mining operations in this district and in the Grand Island district in 1943 were carried on to recover tungsten.

Ward district.—The Boston and Utica mines were operated the entire year by the Ward United Mines Co. and were the leading producers of gold and copper in Boulder County in 1943. Crude smelting ore containing 739 ounces of gold, 802 ounces of silver, and 14,277 pounds of copper was shipped to the smelter at Leadville. The company 25-ton concentration-flotation mill operated only 3 months during the year on low-grade ores from the mine. Small tonnages of ore and concentrates were shipped to the Leadville smelter and the Golden Cycle mill from the Columbia, Golden Casket, and Black Jack mines.

CHAFFEE COUNTY

Granite district.—The production from the Granite district in 1943 came from the Gold Basin placer, operated from July to October by Len Savage and John D. Howard.

Monarch district.—Production from lode mines in Chaffee County in 1943 was restricted to the Monarch district. The Hawkeye mine, operated under lease from Burleson Bros., was the leading producer. Lead ore, averaging 17 percent lead and 6 percent zinc, was shipped to the Leadville smelter. Burleson Bros. operated the Alaska mine under lease and shipped zinc-lead ore to the Golden Cycle mill for treatment.

CLEAR CREEK COUNTY

Argentine district.—The largest operation in the Argentine district was that of O. Barlow Wilmarth on the National, Sussex, and Newcastle claims in Grizzly Gulch 8 miles southwest of Georgetown. Zinc-lead sulfide ore produced was concentrated at the Chicago Creek custom mill; the bulk concentrate was shipped to the Midvale (Utah) custom concentrator for further treatment. Other producers included the Gold Belt, Hamill Tunnel, Sidney, and Stevens mines.

Empire district.—Minnesota Mines, Inc., largest producer of gold in Clear Creek County in 1943, operated continuously its Crown Prince group of mines and 250-ton (daily) flotation-cyanidation mill until June 5, when the mine and mill were shut down. A shortage of labor was the deciding factor in the closing of the property. (See Minerals Yearbook, 1941, p. 301, for method of ore treatment.) A. H. Stone operated the Omaha mine during the latter part of the year and shipped 17 tons of zinc-lead sulfide ore to the Golden Cycle mill at Colorado Springs.

Griffith district.—The largest producer of zinc, lead, and silver in the Griffith district and in Clear Creek County was the Mile High Mining Co., which operated the Smuggler mine and Silver Leaf mill near Silver Plume continuously in 1943. Zinc and lead concentrates were produced and shipped to the Amarillo (Tex.) and Leadville smelters. Operators at the Scotia and Mendota properties made small shipments of bulk concentrates to the Midvale (Utah) smelter. The Golden Cycle Corporation leased the Dives-Pelican mine at Silver Plume during the summer and shipped stope-fill material to its mill at Colorado Springs; other properties in the Griffith district which shipped zinc-lead sulfide ore to the Golden Cycle mill were the Dunbarton, Mendota, Frostberg, and Diamond.

Idaho Springs district.—Virtually all the ore mined from the 13 producing properties in the Idaho Springs district in 1943 was milled in custom mills in the district or at Colorado Springs. Custom mills active during the year, most of them operating only intermittently, included the Clear Creek-Gilpin Co., Ruth, Chicago Creek, and Silver Spruce. The Golden Cycle mill at Colorado Springs received ore shipments during the year from the Idaho Bride, Freighter's Friend, Humboldt, East Lake, Bald Eagle, and Silver Age properties. A clean-up of the Alma Lincoln Mining Co. 150-ton flotation mill produced 73 tons of bulk concentrates shipped to the Leadville smelter and a small quantity of bullion shipped to the Denver Mint. Crude smelting ore was shipped to the Leadville and Tooele (Utah) smelters from the Oregon, Bald Eagle, Idaho Bride, and Salisbury mines.

Montana district.—Production from the Montana district in 1943 comprised 2,747 tons of zinc-lead sulfide ore from the Joe Reynolds and 128 tons of lead ore from the Red Elephant group.

Trail Creek district.—The Harrison Croesus Mining Co. operated the Ben Harrison and Croesus claims on Trail Creek 4 miles southwest of Idaho Springs from March 29 to December 15, 1943. Zinc-lead sulfide ore totaling 991 tons was milled at the Clear Creek-Gilpin Co.

and Silver Spruce mills. Concentrates produced were shipped to the Leadville and Tooele (Utah) smelters. In operation until July 17, Lamartine Mines, Inc., produced 7,921 tons of dry gold ore from which were recovered 391 tons of lead concentrates containing 635 ounces of gold, 6,665 ounces of silver, 2,605 pounds of copper, and 62,025 pounds of lead. A clean-up of the Freeland mill yielded 2 tons of material containing 2 ounces of gold and 7 ounces of silver.

CUSTER COUNTY

Hardscrabble district.—The Lady Franklin mine near Westcliffe, largest producer of gold, silver, lead, and zinc in Custer County in 1943, was operated continuously throughout the year and shipped 4,200 tons of ore averaging 5.6 percent zinc and 3 percent lead to the Golden Cycle mill in Colorado Springs. Other producers in the district, all shipping crude ore to the Golden Cycle mill or to the Leadville smelter, were the Defender, Keystone, New Hope, and Passiflora mines.

Ilse district.—The only production from the Ilse district was two small shipments of lead ore averaging 55 percent lead from the Terrible mine. The mine was reopened in 1942 by G. E. Devereaux with the aid of a loan from the Reconstruction Finance Corporation but was closed again in the latter part of 1943.

DOLORES COUNTY

Pioneer district (*Rico*).—The Rico Argentine Mining Co. operated its group of mines and 135-ton selective-flotation mill continuously in 1943 and milled 33,618 tons of ore averaging 16 percent zinc and 10 percent lead. The products of the mill were lead-silver concentrates (carrying some copper, zinc, and a little gold) shipped to the Leadville smelter and zinc concentrates (carrying also silver, lead, copper, and a little gold) shipped to the Amarillo (Tex.) smelter. The zinc concentrates averaged 51.8 percent zinc and the lead concentrates 64.2 percent lead. Markey Bros. and John Lill operated the Yellow Jacket group during the year and shipped crude zinc-lead ore (carrying some silver, copper, and a little gold) to custom mills in Utah.

EAGLE COUNTY

Red Cliff district (*Battle Mountain*).—The Red Cliff district again ranked first among Colorado districts in output of zinc but dropped to third place in output of copper. The New Jersey Zinc Co. Empire Zinc Division Eagle mine and mill at Gilman were operated continuously in 1943. The company mined and shipped less copper-iron-silver-gold sulfide smelting ore than in 1942 but increased the output of zinc-lead milling ore. The production of zinc from Eagle County was the largest in the history of the county.

EL PASO COUNTY

GOLDEN CYCLE MILL

The Golden Cycle custom mill at Colorado Springs recovered 34 percent of the total Colorado output of gold from lode mines in 1943. It treated 287,939 tons of ore, compared with 378,434 tons in 1942. Of the total ore treated 226,908 tons were gold-[silver]-sulfotelluride ores from the Cripple Creek district (Teller County), and 61,031 tons comprised miscellaneous zinc-lead, gold, and gold-silver ores from other districts in the State, mainly in Summit, Lake, Clear Creek, Custer, Fremont, Saguache, Boulder, Chaffee, Gilpin, and San Juan Counties. As ores purchased vary in character and grade, the metallurgy is not always the same. Ores from Cripple Creek (comprising most of the mill feed) are roasted, amalgamated,[1] and cyanided. Complex ores containing base metals are treated by selective flotation; the tailings from this operation are separated into sand and slimes and cyanided.

Although milling at Colorado Springs was curtailed immediately following the War Production Board Gold Mining Limitation Order of October 1942, the mill was permitted to continue operations in 1943 under several reprieves granted by the War Production Board. Provisions of the first reprieve, issued December 3, 1942, allowed operation until June 8, 1943, and called for conversion of a 300-ton unit of the company milling plant to selective flotation to handle 450 to 500 tons of zinc-lead ore per day. Treatment of dry gold ore from Cripple Creek and Boulder County was permitted because this type of ore was needed in the milling plant. Conversion of the flotation unit to selective flotation was completed the latter part of April 1943. The first shipments of zinc and lead concentrates were made the latter part of May. A further reprieve of indefinite duration was granted August 8, 1943.

FREMONT COUNTY

Cotopaxi district.—The Monarch Galena Co. operated the Cotopaxi mine in the Cotopaxi district throughout 1943 and shipped 3,284 tons of zinc ore (containing some gold, silver, and copper) to the Golden Cycle mill and Midvale (Utah) custom concentrator.

Grape Creek district.—The Horseshoe mine 9 miles southwest of Canon City was operated by Christison & Van Buskirk the last 5 months of the year. Zinc-lead ore (1,576 tons) averaging 6.8 percent zinc and 4 percent lead was sent to the Golden Cycle mill.

GILPIN COUNTY

Southern districts (Blackhawk, Central City, Nevadaville, Russell Gulch).—Eighteen lode and 4 placer mines were active in the Southern districts in 1943. The output of silver, lead, and zinc from Gilpin County increased in 1943, whereas the output of gold decreased 74 percent and that of copper 22 percent. The Widow Woman mine (largest producer of silver, lead, and zinc in the county) was operated the entire year by the G. S. & G. Mining Co. Zinc-lead sulfide ore (carrying some gold, silver, and copper) was shipped to the Golden Cycle mill for treatment. The Pittsburg-Notaway group of mines and 100-ton flotation mill (largest producer of gold in the county) were operated continuously under lease by Kingmill Mines, Inc., until October 27, when the mine and mill were shut down indefinitely. V. C. Lasswell worked the Anchor mine during 9 months of the year and sent ore to the Clear Creek-Gilpin mill at Idaho Springs (Clear Creek County) for treatment. The Powers and Hope claims (largest producers of copper in Gilpin County) were operated throughout the year by the Lu Ev Mining Co.; copper ore and concentrates were shipped to the Garfield (Utah) smelter. Lessees operated the Gold Cup mine and sent crude ore to the Clear Creek-Gilpin and Golden Cycle mills. Ore was also shipped to the Golden Cycle mill from the Banta Hill, Boodle, Bullion, Justice, West Notaway, Tariff, and Washington Day mines.

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[1] Free gold saved on lightweight canton-flannel blankets and amalgamated in iron arrastre.

Small-scale placers worked with screening and sluicing plants in 1943 included the Packard, Morgan, Peerless, and Russell Gulch.

GRAND COUNTY

A small shipment of silver ore was sent to the Golden Cycle mill from the Ready Cash mine near Jones Pass.

GUNNISON COUNTY

Elk Mountain district.—Lessees on the Cincinnati mine made one shipment to the Tooele (Utah) concentrator of zinc-lead-gold-silver ore which had been hand-sorted from the dump.

Quartz Creek district.—An operator on the Complex mine near Pitkin shipped a small quantity of lead ore assaying 24 percent lead to the smelter at Leadville.

Taylor Park district.—In 1943 the Star and Thunderbird mines produced, respectively, 197 and 22 tons of ore (containing zinc, lead, copper, silver, and gold) which were shipped to the Midvale (Utah) custom mill.

Tomichi district.—The Callahan Zinc-Lead Co., Inc., operated the Akron mine throughout 1943. Zinc-lead-silver ore (3,941 tons) was shipped to the Midvale (Utah) custom mill and the Leadville smelter.

HINSDALE COUNTY

Galena district.—The Base Metal Corporation operated under lease the Ute and Ulay group and 100-ton (daily) selective-flotation mill from April through October and produced lead concentrates averaging 60.1 percent lead and zinc-lead concentrates averaging 57 percent combined zinc and lead.

JEFFERSON COUNTY

Two shipments of ore of small content in gold, silver, copper, lead, and zinc were sent to the Golden Cycle mill by a lessee on the Blackmer ranch near Evergreen. This was the only lode operation in Jefferson County in 1943. The bulk of the placer gold and silver produced during the year was recovered from the Tresize placer by W. B. Kerkling and as a byproduct from the gravel-washing plants of the Superior Sand & Gravel Co.

LAKE COUNTY

CALIFORNIA (LEADVILLE) DISTRICT

The American Smelting & Refining Co. operated its Arkansas Valley lead bullion-leady copper matte smelter continuously (one furnace) in 1943 on ores and concentrates purchased from operators in virtually every mining district in Colorado. Receipts of ore and concentrates totaled 80,433 tons, compared with 94,659 tons in 1942.

The Resurrection Mining Co. operated the Resurrection mine and 300-ton selective-flotation mill continuously throughout 1943. The company treated 105,765 tons of zinc-lead sulfide ore from the Resurrection mine and 418 tons of custom ore from six operators in Summit County. Early in the year the company began construction of a 500-ton addition to the milling plant. This addition was not completed and put into operation until January 1944. Development during 1943 included 76 feet of inclined winze, 5,813 feet of drifts, 1,045 feet of raises, and 872 feet of diamond drilling. In addition to the milling ore produced the company shipped 3,351 tons of lead oxide ore to the Arkansas Valley smelter. Combined zinc-lead-gold-silver concentrates produced totaled 16,212 tons, containing 8,709 ounces of gold, 151,306 ounces of silver, 6,022,457 pounds of lead, and 9,384,130 pounds of zinc. Lead concentrates were shipped to the Leadville smelter; zinc concentrates were shipped to Amarillo, Tex. To provide living accommodations for its employees, the company constructed a 32-family housing unit on the south side of California Gulch.

The California Gulch Mining & Milling Co. operated its two gravity- and flotation-concentration and amalgamation mills—one 75- to 125-ton capacity and one 450-ton capacity—throughout the year on ores from the Ibex, Valley, and Fortune mines and the Robert Emmett, Mab, Colonel Sellers, and Wolftone dumps. Early in 1943 the company completed the conversion of its large mill to the recovery of lead and zinc. A washing plant and a set of truck scales were installed at the mill during 1943. The John Hamm Mining & Milling, Ltd., operated its 300-ton amalgamation-gravity concentration-flotation mill the entire year on ore from the Ibex and Fanny Rawlings dumps. Construction of a 600-ton jig plant to rough-concentrate zinc-lead dump ores was in progress during the latter half of the year. The jig plant was not put into steady operation until early in 1944, when the company closed its 300-ton flotation plant.

The first Heavy-Media separation plant to be constructed in Colorado and the first in the country to use a ferrosilicon medium in the bulk concentration of nonferrous metal ores began production on July 28 when the Ore & Chemical Co. completed its 1,000-ton mill 1½ miles west of Leadville. The mill, built primarily to treat old dump material in the Leadville district, operated the remainder of 1943 on ore from the South Moyer dump in California Gulch. The ore is crushed to 1¼-inch size and deslimed, and the oversize is screened to make a separation at 10-mesh. Oversize is fed to a differential density cone containing a ferrosilicon medium of 3.00 specific gravity. The higher gravity of the ore makes the recovery of the bulk concentrate possible as a sink product; the float material is discarded as waste. Undersize is fed to a two-cell placer jig, the tailings of which go to waste. Concentrates from the cone and jigs are shipped to the Golden Cycle mill at Colorado Springs for further concentration.

The Golden Cycle mill at Colorado Springs also treated ore from the Fortune and Little Johnny mines. The principal shippers of smelter ore to the Leadville smelter and smelters in Utah (in approximate order of tonnage) were the Rock and Dome, Wolcott dump, Ibex, Flagstaff dump, New Monarch, Breece dump, Dolly B, Gallagher, Golden Eagle, Adelaide, Little Ellen, and Valley.

In June 1943, Congressional action made available $1,400,000 appropriated for the construction of a 2.55-mile tunnel to unwater the mines of the Carbonate Hill, Evans Gulch, and Fryer Hill areas north and east of Leadville and the Downtown area within the city. It is anticipated that this tunnel will drain 65 to 90 percent of the mine water of the Leadville area above the 9,950-foot tunnel level. Actual tunnel driving was not begun until December 7, 1943.

LA PLATA COUNTY

California (or La Plata) district (Hesperus, La Plata).—The metal output from the California district in 1943 was from small shipments of ore from the Bessie G and Bunny mines to the Midvale (Utah) smelter. Lessees made a shipment of dump ore to Leadville from the old American Smelting & Refining Co. smelter dump at Durango.

MINERAL COUNTY

Creede district.—The Emperius Mining Co. operated its 100-ton flotation mill the entire year on ore from the Amethyst, Equinox, New York, Last Chance, Volunteer, Pittsburg, and Happy Thought mines. Lead-silver-gold concentrates produced were shipped to the smelter at Leadville. The company also shipped crude lead-silver ore direct to the Leadville smelter from the Amethyst, Commodore, Pittsburg, Happy Thought, and Robinson mines. The Ridge Leasing Co. operated the Ridge mine the last 6 months of 1943 and shipped zinc-lead milling ore (carrying some gold and silver) to the Tooele (Utah) concentrator. The production of silver from the Creede district decreased 22 percent from 1942.

MONTROSE COUNTY

La Sal district.—The New Cashin Mines, Inc., operating the Cashin group, shipped copper fluxing ore averaging 3.2 percent copper to the Garfield and Tooele (Utah) smelters. A 3¼-mile access road to this property was constructed by the Federal Grazing Service to facilitate the moving of ore to the smelter.

San Miguel River (Naturita) district.—Individuals sluicing on the San Miguel River recovered small lots of placer gold in 1943.

OURAY COUNTY

Red Mountain district.—Seven mines were producing in the Red Mountain district in 1943. Among the larger operators were Wm. McCullough, who shipped dump ore from the Mountain King mine to the General Ore Reduction mill, and the Denver Engineering Co., which operated the San Antonio mine through the Koehler tunnel at the top of Red Mountain Pass and shipped crude zinc-lead ore to the Midvale (Utah) custom concentrator. Other producers shipping ore to the General Ore Reduction Co. mill and to the Midvale (Utah) mill were the Beaver-Belfast group and the Red Mountain, Barstow, and Kentucky Giant mines.

Sneffels district.—The Camp Bird mine and 100- to 125-ton amalgamation-flotation mill, under lease to King Lease, Inc., were operated continuously in 1943 through the 11,000-foot crosscut tunnel. (See Minerals Yearbook, 1941, p. 308, for methods of ore treatment.) The mine was the largest producer of gold, silver, copper, lead, and zinc in Ouray County in 1943. Zinc-lead-silver ore totaling 309 tons was shipped to the General Ore Reduction Co. custom mill from the Agnes, Camp Bird Extension, Monument, Revenue, and Yankee Boy mines, *Uncompahgre district.*—The General Ore Reduction Co., successor to G. A. Franz, Inc., remodeled the old Banner American mill and purchased ores in 1943 from Ouray and San Juan Counties. During the year 1,314 tons of ore were milled, averaging 0.02 ounce of gold and 5.0 ounces of silver to the ton, 0.2 percent copper, 6.0 percent lead, and 3.8 percent zinc. Lead-silver-zinc concentrates were shipped to the Midvale (Utah) mill and smelter. The McCullough Lease treated old mill tailings from the Wanakah dump and shipped the product to the Midvale (Utah) smelter. The Bachelor Consolidated group of claims, under lease to Julius Sonza, was worked continuously in 1943. Zinc-lead-silver ore was produced and sent to the General Ore Reduction Co. mill for treatment. Other mines operating in the Uncompahgre district in 1943 were the Highland Chief and the Michael Breen.

PARK COUNTY

Alma Placers district.—H. J. McLaughlin worked the Alma Placers in 1943 and shipped two small lots of gold amalgam to the Denver Mint.

Buckskin district.—The Buckskin Joe Mines, Ltd., operated the Phillips group of mines in Buckskin Gulch and the Alma-Betts 65-ton selective-flotation mill in Mosquito Gulch throughout 1943. The products of the mill were zinc, lead, and iron concentrates. Lessees on the Red Cross and the Sweet Home mines shipped crude zinc-lead ore to the Golden Cycle mill for treatment.

Consolidated Montgomery district.—The Magnolia Gold Mining Co. operated the Lee Goss lode from April through December 1943 and produced 700 tons of zinc-lead ore (carrying some gold, silver, and copper), which were shipped to the Golden Cycle mill for treatment. A small tonnage of crude ore containing gold, silver, and lead was shipped to the smelter at Leadville. The company 50-ton flotation mill in Montgomery Gulch was not operated in 1943. Two small shipments of crude lead-silver ore were made to the Leadville smelter from the Mineral Park mine.

Fairplay district.—One small sluicing operation on the Snowstorm placer 2 miles north of Fairplay was the only activity in the Fairplay district in 1943. All dredging was at a standstill the entire year.

Mosquito district.—The London Mines & Milling Co. operated its consolidated group of mines on London Mountain and 200-ton flotation mill on South Mosquito Creek continuously until October 20, when operations were discontinued; the mill and other equipment were sold. Dry gold concentrates (carrying also silver, copper, and lead) were sold to the Leadville smelter. The mine was the largest producer of gold, silver, and lead in Park County in 1943. The Orphan Boy mine was worked throughout most of the year, and shipments of zinc-lead sulfide ore were made to the Golden Cycle mill. Clean-up at the London Butte Gold Mines Co. mines yielded concentrates that were sold to the Leadville smelter.

Pulver district.—The Great Western mine on Wilkerson Pass 10 miles west of Lake George was operated the last 6 months of the year by O. N. Sandholm. Zinc ore averaging about 7 percent zinc was sent to the Golden Cycle mill for treatment.

PITKIN COUNTY

Roaring Fork district (*Aspen*).—The Midnight Mining Co. operated the Midnight mine and 50-ton flotation mill on Richmond Hill continuously 6 days a week in 1943. The mine produced 12,122 tons of silver-lead-zinc ore averaging 30.6 ounces of silver to the ton, 3.3 per cent lead, and 5 percent zinc. The products after milling were silver-lead concentrates, sent to the Leadville smelter, and zinc concentrates, sent to Amarillo, Tex. D. P. Rohlfing and his successors (after his death) continued to ship from the Aspen Leases to the Leadville smelter lime fluxing material carrying silver and lead. Herron Bros. treated about 3,000 tons of silver-lead-zinc-bearing material from the Henry Clay dump in the company mill north of Aspen and shipped silver-lead concentrates to the Leadville smelter and zinc-lead concentrates to the Golden Cycle mill for further treatment.

RIO GRANDE COUNTY

Summitville district.—The Gold Links Mining Co., working the Little Annie Group of mines the entire year, was the only producing company in the county in 1943. The mine produced 3,350 tons of ore, which were treated at the company 50-ton stamp (10 stamps) and flotation mill. In addition to amalgamation bullion, which was shipped to the Denver Mint, the mill produced 260 tons of copper concentrates containing 1,861 ounces of gold, 1,366 ounces of silver, and 19,036 pounds of copper.

ROUTT COUNTY

Milbank Franz shipped 355 tons of zinc ore containing 2.78 ounces of gold, 534 ounces of silver, 4,437 pounds of copper, 12,601 pounds of lead, and 91,555 pounds of zinc from the Greenville mine in the Hahns Peak area to custom mills in Utah.

SAGUACHE COUNTY

Kerber Creek district (Bonanza).—The 1943 production of gold, copper, and zinc in the Kerber Creek district increased over that in 1942. The largest output came from the Bonanza mine dump and the Erie mine. Brugger & Keserich worked the Bonanza dump from March through December and made regular shipments to the Golden Cycle mill. Crude ore was shipped to the custom concentrator at Midvale (Utah) and the Leadville smelter from the Erie mine, operated throughout 1943 by Pickering and Olive Mines. The Pratt-Bonanza Mining & Milling Co. operated the St. Louis mine under lease throughout the year and shipped crude zinc-lead milling ore to the Combined Metals Reduction Co. custom mill at Bauer, Utah. The ore shipped averaged 4.1 ounces of silver to the ton, 6.4 percent lead, and 13.5 percent zinc, as well as a low content of gold. Lessees on the Rawley No. 1 mine shipped lead-silver-copper-gold ore to the Leadville smelter and zinc-lead ore to the Golden Cycle mill. Other producers of ore sold to the Golden Cycle mill were the Warwick and Silver Creek mines and the Cocomongo dump.

SAN JUAN COUNTY

Animas district.—The Shenandoah-Dives Mining Co. continued to operate as a single unit its consolidated group of claims on King Solomon Mountain and the Silver Lake group leased from the American Smelting & Refining Co. The ore mined was milled in the company 700-ton selective-flotation mill on the Animas River near

Silverton. The lead and zinc concentrates produced contained 17,498 ounces of gold, 165,515 ounces of silver, 431,134 pounds of copper, 1,901,761 pounds of lead, and 777,282 pounds of zinc; the lead-copper and iron (lead) concentrates were shipped to the Leadville smelter and the zinc concentrates to the smelter at Amarillo, Tex. Custom ore milled at the company mill came from 14 mines in the Animas, Eureka, and Ice Lake districts. Development in 1943 at the Silver Lake and Shenandoah-Dives groups consisted of 2,640 feet of drifts, 191 feet of raises, and 286 feet of diamond drilling. The Highland Mary group of mines and 70-ton flotation mill in Cunningham Gulch were operated from June to November, when operations ceased owing to severe winter weather and snow slides. Concentrates from this property were shipped to the Leadville smelter. The Denver Equipment Co. operated the 100-ton Pride of the West selective-flotation mill at Howardsville continuously in 1943 on company ore from the Pride of the West group. The ore milled averaged 0.069 ounce of gold and 3.5 ounces of silver to the ton, 5.5 percent lead, and 1.3 percent zinc. Lead concentrates averaging 63.5 percent lead were shipped to the Leadville smelter; zinc concentrates averaging 54.6 percent zinc were shipped to the Amarillo (Tex.) smelter. Other mines shipping ore to the Shenandoah-Dives custom mill or the Golden Cycle mill at Colorado Springs were the Belcher, Henrietta, Lark, Little Fannie, Little Ida, Mogul, and Little Nation.

Eureka district.—Most of the ore produced at mines in the Eureka district in 1943 was sold either to the Shenandoah-Dives or the Golden Cycle mill. The largest producers, in order of output, were the Mountain Queen mine (operated from August to November by the Mountain Queen Lease) and the Columbus and London mines. One shipment of zinc-lead ore went to the custom mill at Bauer (Utah) from the Columbus mine.

Ice Lake Basin district.—The only output from the Ice Lake Basin district in 1943 was 64 tons of zinc-lead ore shipped to the Shenandoah-Dives mill from the Bandora mine near the head of South Mineral Creek.

SAN MIGUEL COUNTY

Upper San Miguel district (Telluride).—Telluride Mines, Inc., operated throughout 1943 its 550-ton amalgamation and gravity- and flotation-concentration mill at Pandora 2½ miles east of Telluride and treated 145,036 tons compared with 146,211 tons in 1942. The ore treated in 1943 came from the Smuggler Union, Cimarron, and Montana mines in the Telluride district and from the Humboldt mine in the Sneffels district of Ouray County. Development consisted of 42 feet of raises and 532 feet of drifts. Alta Mines, Inc., continued to operate the Alta-St. Louis group and 100-ton gravity- and flotation-concentration mill throughout the year but with decreased production due to lack of men. A small quantity of bullion recovered by amalgamation was shipped to the Denver Mint from the Allegheny and Telluride claims.

On the strength of a favorable report by the district engineer of the Federal Bureau of Mines at Denver, the Metals Reserve Co. arranged with the Idarado Mining Co. on June 11, 1943, to lease the Black Bear property in Ingram Basin on the Telluride side of Columbia Mountain. A loan of $1,300,000 was obtained from the Reconstruction Finance Corporation to reopen and develop the mine.

A contract was granted to extend the Treasury tunnel (Red Mountain district, Ouray County) (already in 5,539 feet) another 6,300 feet to a point beneath the old Black Bear workings and to raise approximately 1,100 feet to connect the tunnel level with the No. 6 level of the Black Bear. Actual tunneling was begun on July 13, and on October 16 the Black Bear vein was intersected. After some delay, to decide whether or not the vein would be prospected at once from this junction, the contractor was instructed to drive ahead as originally planned to a point beneath the old Black Bear shaft. This point was reached early in 1944, and after several crosscuts had been driven to explore the ore body it was decided not to drive the raise but to develop the vein from the Treasury tunnel level. The Sunshine Mining Co. of Idaho was appointed as agent for the Metals Reserve Co. to operate the mine, and at the present date (June 13, 1944) the development program is progressing satisfactorily. The 250-ton mill at the portal of the tunnel probably will be expanded to 500 tons daily capacity.

SUMMIT COUNTY

Breckenridge district.—The largest operation in the Breckenridge district in 1943 was the Golden Cycle Corporation lease on the Monte Cristo mine near the summit of Hoosier Pass. Work at the property was begun in June 1943, and after necessary mining equipment had been installed shipments were started in July to the Golden Cycle mill at Colorado Springs. From June to December 10, when operations ceased owing to winter weather conditions, 11,217 tons of low-grade zinc-lead sulfide ore were produced. Other properties from which crude milling ore was shipped to the Golden Cycle mill were the Country Boy mine and Wellington dump. Several cars of crude smelting ore were shipped to the Leadville smelter from the Button and Minnie B mines. Milling ore totaling 56 tons and averaging 25 percent zinc and 5 ounces of silver to the ton was shipped from the Sally Barber mine to the Midvale (Utah) custom concentrator.

Green Mountain district.—Walter McDaniel continued producing zinc-silver-lead-gold-copper ore from his Big Four mine on Green Mountain 17 miles south of Kremmling. The output in 1943 was 510 tons of ore (shipped to custom mills in Utah) containing 286,664 pounds of zinc, 5,561 ounces of silver, 5,492 pounds of lead, 14.80 ounces of gold, and 1,360 pounds of copper.

Montezuma district.—Properties in the Montezuma district from which zinc-lead sulfide ore was trucked to the Resurrection Mining Co. mill at Leadville were the Burke group, New York, Superior, and Morgan group. The Florado Mining Co. operated the Florado mine and 100-ton selective-flotation mill 7 months during 1943 and shipped lead concentrates to the Leadville smelter and zinc concentrates to the Amarillo (Tex.) smelter. The Rogers Mines, Inc., operated the Morgan group of claims from August to December and, in addition to shipping to the Resurrection mill, shipped 234 tons of ore containing 4.15 ounces of gold, 511 ounces of silver, 2,909 pounds of copper, 10,599 pounds of lead, and 111,044 pounds of zinc to the Golden Cycle mill and Tooele (Utah) lead smelter. Twenty-eight tons of lead ore were shipped to the Leadville smelter from the Pennsylvania mine. Several cars of zinc-lead sulfide ore were shipped to the Midvale (Utah) custom mill from the Clara and Superior mines.

Ten Mile (Kokomo, Robinson) district.—The Wilfley Leasing Co. operated its Wilfley mine and 75-ton selective-flotation mill 1 mile west of Kokomo throughout 1943. The mill handled 9,063 tons of ore, composed largely of marmatite and pyrite, yielding 97 tons of lead concentrates and 1,476 tons of zinc concentrates which were shipped to the Leadville and Amarillo (Tex.) smelters. L. J. Gould and A. R. Rhine continued to operate the Washington and Hancock group (known as the Lucky Strike group) throughout 1943 and produced 6,367 tons of crude milling ore which were shipped to the Midvale (Utah) custom concentrator and the Golden Cycle mill at Colorado Springs. Several truckloads of dry silver ore were shipped to the Leadville smelter from the Golden Queen and Queen of the West mines. The Kimberly property was reopened by Kokomo-Kimberly Mines, Inc., on May 16 and continued to operate the remainder of the year. Ore shipped to the Golden Cycle mill at Colorado Springs totaled 611 tons and contained 84.63 ounces of gold, 1,619 ounces of silver, 1,701 pounds of copper, 7,758 pounds of lead, and 128,491 pounds of zinc. Three carloads of test ore from the Nettie B mine were also shipped to the Golden Cycle mill.

TELLER COUNTY

CRIPPLE CREEK DISTRICT

Except for several years, Cripple Creek has been annually the leading gold-producing district in Colorado, and its total output makes it rank first among gold-producing districts. From 1891, when gold was discovered in that area, through 1943 it has yielded a total of 18,465,849 fine ounces valued at $399,879,197, or 48 percent of the State total output of gold from 1858 to 1943, inclusive. In 1943 the district produced 45,105 ounces (33 percent of the State total) compared with 104,455 ounces (39 percent) in 1942 and 133,470 (35 percent) in 1941. The decreased production of gold in 1942 and 1943 reflects the effect of the Gold Mining Limitation Order of October 1942 on the mining industry of the Cripple Creek district. The total production of ore from Cripple Creek mines and dumps in 1943 was 226,908 tons, all treated in the Golden Cycle mill (operations reviewed under El Paso County). Cripple Creek ores generally contain gold as the only commercial metal, but some silver ore has been shipped from two or three veins in the district; a small quantity of silver is recovered annually in bullion and concentrates produced from the gold ores.

MINES REVIEW

Operations of the Golden Cycle Corporation, which owns and operates the Golden Cycle mill at Colorado Springs and several mines in the Cripple Creek district, are described in the following extract from its annual report to stockholders for the year ended December 31, 1943 (dated April 15, 1944):

> Stockholders have been fully informed in prior reports from the Golden Cycle Corporation of the order of the Mining Branch of the War Production Board, Washington, D. C., entitled "Limitation Order L–208" closing down all "non-essential" gold mines in the United States, its territories or possessions. The Appeals Branch of the War Production Board on December 3, 1942, granted an extension of six months to the Golden Cycle Corporation to operate under certain restrictions from December 8, 1942, to June 8, 1943; and, thereafter, a further extension was granted, effective August 8, 1943, to continue gold mining operations

in Cripple Creek, Colo., and to accept gold ore from other mines and lessees at Cripple Creek and in Boulder County, subject to certain conditions, chief of which was:

> "That the milling of base metal ores be increased as rapidly as such ores become available and every effort be made to actively engage in the mining of base metal ores for our own account, that facilities and equipment now used in gold mining and milling be transferred for use in base metal mining and milling whenever necessary and suitable, that the milling of gold ores shall in no way conflict with expansion in base metal milling capacity."

During the latter part of 1942 the management had already started to convert the facilities and operations of the corporation to the war effort wherever and however possible. Our chief activities during 1943 to aid the war effort were as follows:

Production of strategic metals.—(1) Conversion of the flotation units at the Golden Cycle mill to handle approximately 450 to 500 tons of zinc-lead ores per day was finished in the latter part of April 1943. First shipments of concentrates were made the latter part of May 1943. During the period January through December 31, 1943, a total of 58,802 tons of complex ore with a gross value of $524,935 were purchased from shippers for the production of zinc-lead concentrates. It is significant to note that the complex ore purchased during this period contained the following metals: 9,460,280 pounds of zinc; 4,470,839 pounds of lead; 280,800 pounds of copper; 182,191 ounces of silver; and 3,825 ounces of gold; gross value $524,935.

(2) During 1943, 6,325 tons of zinc concentrates were shipped to the smelters of the American Zinc Co. at Dumas, Tex., and 3,001 tons of lead concentrates shipped to the American Smelting & Refining Co. at Leadville.

(3) Since the gold ore at Cripple Creek contains no strategic metals such as zinc, lead, or copper, it has been necessary for the Golden Cycle Corporation to build up the necessary production of zinc-lead ores for treatment at our mill from all parts of the State of Colorado. Zinc-lead ore for the Golden Cycle mill at Colorado Springs is shipped from zinc-lead mines located in and near Leadville, Montezuma, Kokomo, the Bonanza district, Alma, Clear Creek County, San Juan County, and other mineralized areas of Colorado. The Golden Cycle Corporation also was engaged in the operation, during 1943, of several zinc-lead properties on its own account. We operated a lease on the Pelican-Dives property at Silver Plume, Colo.; the results were disappointing. We also operated a lease on the Monte Cristo property located near Hoosier Pass, Summit County, Colo. Work commenced late in June 1943, and after installation of power lines, machinery and equipment, building of roads, etc., shipments were started to the Golden Cycle mill from a deposit of lead-zinc ores lying on top of the ground. This ore was trucked 52 miles to Buena Vista, then loaded on railroad cars of the Denver & Rio Grande Western Railroad, and shipped via rail to the mill at Colorado Springs. For the period June 1943 to December 10, 1943 (at which time it became necessary to shut down operations due to winter weather conditions), 11,217 tons of low-grade ore were produced and shipped to the mill. While the ore was low grade it was helpful to permit the mill to maintain sufficient tonnage of zinc-lead ores until complex ores from other sources could be brought in.

(4) At present the average daily tonnage of lead-zinc ores being received at the mill approximates 500 tons per day. Additional work is now being done in the flotation unit to increase our daily capacity, and it is expected that during 1944 a large tonnage of zinc-lead ores will be treated.

Production of railroad ballast and crushed rock.—During 1943 the Midland Terminal Railway furnished the Rock Island Railroad with approximately 57,513 yards of ballast for use by the Rock Island on its main line from Colorado Springs east. This ballast, a fine decomposed granite product, was furnished from a pit located along the Midland's roadway.

The shops of the Midland Terminal Railway continued to manufacture small items used in aircraft construction.

A substantial tonnage of crushed rock was furnished from the Cripple Creek waste dumps to army installations in the vicinity of Colorado Springs.

Production of coal and power.—Work is now well along at the power plant of the Golden Cycle Corporation, located at our Pikeview coal mine, seven miles north of Colorado Springs, to greatly increase the capacity of the power plant to furnish standby service to the City of Colorado Springs, which operates a municipally-owned utility. This utility furnishes power to army and air camps located in the vicinity of Colorado Springs. We now have the capacity to provide, if necessary, a large steady load to power users.

Production of the coal mine for 1943 was above normal. This was due to the fact that we furnished army camps located within the vicinity of Colorado Springs and elsewhere in the State of Colorado with coal. Due to the defense activity within the vicinity of Colorado Springs the demand by local consumers of coal has also been increased.

Gold-mining operations. Ajax, Anchoria Leland, and Index mines.—Gold mining operations of the Golden Cycle Corporation were greatly curtailed during 1943 due not only to the effect of Limitation Order L–208, but also to the very acute manpower shortage existing in the Cripple Creek district; practically all able-bodied men in the district have gone into the armed forces or to higher-paid defense jobs. Because of the small production of mine-ore it became necessary to ship a large tonnage of dump rock to furnish sufficient ore to the Golden Cycle mill to operate. Approximately 75 percent of gold ore shipped from the Cripple Creek district during 1943 was dump rock.

Work was carried on at the Ajax mine during the year with a very small crew of men. Some good chutes of ore were opened up on the 26th, 27th, and 28th levels. 37,278 tons of dump ore, with an average value of $3.08 per ton, were shipped from the Ajax Monument dump to the Golden Cycle mill.

Very little work was done on the Anchoria Leland during the year. No underground work was done on the Index, but a small tonnage was shipped by lessees from the Index dump.

Carlton drainage tunnel.—In July 1943 a cave-in occurred in the Carlton tunnel and partially blocked it. After considerable difficulty and expense the cave-in was removed and the tunnel opened. At present we are replacing timbers to prevent such trouble in the future. The tunnel has proved a tremendous benefit in keeping water drained from the mines in the Cripple Creek district during the shutdown period created by the war. Water produced by the tunnel was sold for irrigation purposes.

At this time it is impossible to forecast with any certainty the future of our company during the war period. Every effort will be made to continue with our activities in connection with producing war necessities. Stockholders are assured that every effort will be made to conserve the properties and assets of the corporation for the stockholders' best interest, with the expectation that with the end of the war, operations can again be resumed upon a normal basis.

The annual report of the United Gold Mines Co., an operating and holding company for property scattered throughout the Cripple Creek district, for the year ended December 31, 1943 (dated February 15, 1944), gives the following details on operations at individual mines:

Herewith is annual statement of the United Gold Mines Co. for the twelve months ended December 31, 1943.

Comparative statistics follow:

	1943	1942	Decrease (−) or increase (+)
Operating gain or loss	($13, 102)	$40, 623	−$53, 725
Current assets	198, 894	218, 946	−20, 052
Current liabilities	58, 091	67, 142	−9, 051
Working capital	140, 803	151, 805	−11, 002
Gross value of company ore produced	349, 534	140, 314	+209, 220
Gross value of lessees ore produced	352, 143	867, 379	−515, 236
Total gross value company and lessees ore	701, 677	1, 007, 693	−306, 016

The stockholders are familiar with Limitation Order L–208 entered on October 8, 1942, by the Mining Branch of the War Production Board, Washington, D. C. This order closed all "non-essential" gold mines in the United States, its territories or possessions. On December 8, 1942, permission was granted to the United Gold Mines Co. to mine gold ore for a period of six months commencing December 8, 1942, expiring June 8, 1943, with certain restrictions. This permission was subsequently extended from June 8, 1943, to August 8, 1943, and thereafter again extended by the War Production Board on a limited basis.

Despite this extension, because of the fact that practically all able-bodied men in the Cripple Creek Mining district have either entered the armed forces of the United States or left the Cripple Creek district to take defense jobs, and the difficulty in securing necessary mining supplies during the year 1943, the smallest amount of work in the history of the company was done on various United Gold Mines Co. properties.

A résumé of our operations follows:

Production during the year 1943 was 129,014 tons with average value of $5.44 per ton. Of this total, 72,566 tons, of the average value of $3.35 per ton, was shipped from the Theresa dump; the balance of 56,448 tons was shipped from other United Gold Mines Co. properties.

Portland No. 1 and No. 2 shafts, the Vindicator and Rose Nicol shafts were operated by the company chiefly for the accommodation of split-check lessees. The number of lessees now working on United Gold Mines Co. properties is the lowest in many years. There are only twenty-four sets of lessees now working on the above four shafts.

Portland operation.—Production from the Portland shafts for 1943 was 6,002 tons of company ore, with average value of $10.09 per ton. Lessees' production was 3,947 tons, with average value of $14.97 per ton. The bulk of the company ore was "cave muck" mined on the old stopes in the 27th, 29th, and 30th levels of the Portland mine 1,704 feet of development work was done by the company and lessees during the year.

Vindicator operation.—The company shipped 4,938 tons of ore, with an average value of $6.12 per ton. This ore was principally screenings from the rock crushing plants. Lessees shipped 18,812 tons of ore, with an average value of $6.01 per ton. Development work totaled 2,272 feet by both company and lessees.

Rose Nicol operation.—Company ore shipped amounted to 768 tons, with an average value of $9.83 per ton. Lessees shipped 3,566 tons, with an average value of $12.15 per ton. 1,370 feet of development work was done during the year by both company and lessees.

Patti Rosa operation.—The Patti Rosa shaft located on the north side of Bull Hill is the only shaft now being operated by lessees. A fair tonnage of ore was shipped from this shaft during 1943.

Ballast pit operation.—During the summer and fall of 1943 the United Gold Mines Co. operated a ballast pit located at mile post 32 on the Midland Terminal Railway. This ballast was produced for the Rock Island Railroad which used it on the main lines from Colorado Springs to Chicago. Total ballast produced during the season was 57,686 yards. Due to the heavy traffic railroads are handling because of the war emergency, ballast is one of the most essential war items.

During 1943 the United Gold Mines Co. also produced crushed rock for army camps located in the vicinity of Colorado Springs. Production was 6,160 tons for the year.

It is hoped that during 1944 the War Production Board will modify Limitation Order L–208 to permit gold mines to resume operations. However, even in the event such modification is made, it is doubtful whether or not sufficient miners and the material necessary to mine can be secured to operate the properties of the United Gold Mines Co. on any kind of normal basis during the war period. Our company's immediate future, certainly during the war, appears at this time very uncertain and no accurate forecast can be made.

Production of company ore by United Gold Mines Co. in 1943

Mine	Net tons	Gross value [1]	Company ore cash receipts	Average gross value per ton [1]
Vindicator	4, 938	$30, 240	$13, 909	$6. 12
Rose Nicol	768	7, 544	4. 267	9. 83
Portland	6. 002	60, 572	35, 330	10. 09
Theresa-Cycle Dump	72, 566	242, 759	34, 126	3. 35
No. 2 Plant	2, 054	8, 419	2, 428	4. 10
	86, 328	349, 534	90, 060	4. 05

[1] Gross value calculated at settlement value of $33.50 per fine ounce of gold content.

Production of lessee ore of United Gold Mines Co. in 1943

Group	Net tons	Gross value [1]	Royalties received	Lessees' receipts	Average gross value per ton [1]
Vindicator	18, 813	$113, 013	$19, 459	$31, 563	$6. 01
Rose Nicol	3, 566	43, 336	13, 152	14, 144	12. 15
Portland	3, 947	59, 093	19, 183	20, 301	14. 97
Bull Hill Group	16, 361	136, 701	8, 243	56, 921	8. 36
	42, 687	352, 143	60, 037	122, 929	8. 25

[1] Gross value calculated at settlement value of $33.50 per fine ounce of gold content.

Production of properties of United Gold Mines Co. before and after organization of the company (May 15, 1902) to December 31, 1943

	Net tons	Gross value [1]
Ore mined before consolidation	26, 310	$456, 806
Production under operation of United Gold Mines Co	2, 468, 425	25, 084, 396
Total to Dec. 31, 1943	2, 494, 735	25, 541, 202

[1] Settlement value.

The annual report of the Cresson Consolidated Gold Mining & Milling Co. for the 12 months ended December 31, 1943 (dated February 1, 1944), says—

PRESIDENT'S REPORT

Stockholders have been fully informed relative to Limitation Order L–208 which was entered October 8, 1942, by the Mining Branch of the War Production Board, Washington, D. C. This order closed down all "non-essential gold mines in the United States, its territories or possessions." On December 8, 1942, permission was granted to the Cresson to mine gold ore during a period of 6 months beginning December 8, 1942, expiring June 8, 1943, provided, that no worker should be employed if the War Manpower Commission found he was needed at mining operations elsewhere.

This permission was subsequently extended from June 8, 1943, to August 8, 1943, and thereafter again extended on a limited basis. However, due to the utter impossibility of securing sufficient labor to operate our property since almost all of our miners had either entered the armed forces of the United States or left the Cripple Creek mining district to take higher paying defense jobs, coupled with the impossibility to secure necessary mining supplies, it was necessary to shut down the Cresson mine. Consequently there are no mining operations going on in the Cresson mine at present and it remains in a standby condition.

The machine shops at the Cresson mine have been busy on some war contracts and during 1943 manufactured small essential war items of a nature which could be handled with the machine shops located at the Cresson mine.

Production of Cresson Consolidated Gold Mining & Milling Co., 1903 to December 31, 1943

Period	Dry short tons	Gross value[1]	Freight and treatment	Net value
1903 to Dec. 31, 1942	3,194,378	$46,190,822	$15,246,688	$30,944,134
1943:				
Company ore	8,155	58,403	28,494	29,909
Lessee ore	11,861	152,483	54,024	98,459
1903 to Dec. 31, 1943	3,214,394	46,401,708	15,329,206	31,072,502

Period	Royalties received by company	Amount paid lessees	Average gross value per ton	Average net value per ton	Dividends
1903 to Dec. 31, 1942			$14.46	$9.69	$13,552,473
1943:					
Company ore			7.16	3.67	12,200
Lessee ore	$47,855	$50,604	12.86	8.30	
1903 to Dec. 31, 1943			14.44	9.67	[2] 13,564,673

[1] Gross value in 1943 calculated at settlement value of $33.50 per fine ounce of gold content.

[2] Represents 29.23 percent of gross value and 43.65 percent of net value.

Shipments from the Stratton properties in 1943 totaled 6,767 tons of ore, which had a total gross settlement value of $142,957.64 or an average settlement value of $21.13 per ton. About a third of the ore produced was dump ore shipped from three groups of dumps on Bull Hill. The principal producers of mine ore were A. B. Cobb, J. E. Vanderwalker, E. L. Grimes, and John Reid.

Other producing mines and dumps in the Cripple Creek district in 1943 included the Mary McKinney, Empire Lee, Acacia, Free Coinage, Forest Queen, Economic dump, Joe Dandy, Prince Albert, and New Gold Dollar.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES

(MINE REPORT)

By A. J. MARTIN

SUMMARY OUTLINE

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SUMMARY

Copper, lead, and zinc mines and ore-reduction mills in the Eastern States operated at a slightly higher daily average crude-ore tonnage rate in 1943 than in 1942, despite a shortage of labor that prevented some properties from attaining maximum output. Several newly developed or recently reopened mines were put in operation during the year, as the mining industry, in cooperation with Government agencies, acted to maintain production at a high level as long as required for war purposes. The total output of recoverable copper, lead, or zinc varied little from 1942, and there was no large change in output in the various States. Copper production was nearly the same as in 1942 in North Carolina but decreased in Pennsylvania and increased in Tennessee. Vermont, which produced no copper from 1931 to 1942, inclusive, contributed to the output after the old Elizabeth mine was reopened at South Strafford in September 1943. Nearly all the lead came from mines producing zinc as the metal of chief value; output decreased in New York and Tennessee and increased in Virginia. Zinc production showed little change in New York and New Jersey but decreased in Tennessee and increased in Virginia. Of the 199,233 tons of recoverable zinc produced in 1943 two mines in New Jersey contributed 47 percent, three in New York 23 percent, seven in Tennessee 20.5 percent, and two in Virginia 9 percent; six small mines and prospects in Tennessee and Virginia together contributed 0.5 percent. Some of the large mines continued to operate without receiving the Government premium for any part of their output, and less than 5 percent of the total "mine" value of the zinc concentrates (calculated for all concentrates upon the basis of the average value reported for New York, Tennessee, and Virginia concentrates) represented premiums for overquota production. Gold output in the Eastern States decreased heavily in 1943 owing to the wartime shut-down of all the important producing gold mines; the quantity of gold recovered from base-metal ores was approximately the same as in 1942. Silver production increased in 1943 owing to expanded output of silver-bearing copper and zinc-lead ores.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported, except that of zinc in New Jersey, has been calculated at the prices in the following table. The value of the New Jersey output is the total value of the zinc recoverable as metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Annual figures for the 5 years ended with 1943 are given in the table that follows. The figures for tonnage of ore sold or treated do not include magnetite ore containing pyrite and chalcopyrite, from which copper, gold, and silver were recovered as byproducts.

Mine production of gold, silver, copper, lead, and zinc in the Eastern States, 1939–43, in terms of recovered metals

Year	Mines producing		Ore sold or treated (short tons) [1]	Gold (lode and placer) [2]		Silver (lode and placer) [3]	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	47	24	3,409,619	17,414	$609,490	94,083	$63,862
1940	40	18	3,674,815	18,456	645,960	102,825	73,120
1941	43	14	3,780,397	21,982	769,370	106,051	75,414
1942	36	17	[4] 4,130,226	14,699	514,465	105,307	74,885
1943	29	3	4,211,961	2,878	100,730	128,129	91,114

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
1939	21,295,000	$2,214,680	6,284	$590,696	180,955	$21,100,174	$24,578,902
1940	25,490,000	2,880,370	4,831	483,100	178,815	24,135,445	28,217,995
1941	27,132,000	3,201,576	5,513	628,482	191,310	29,484,423	34,159,265
1942	28,404,000	3,436,884	4,475	599,650	199,809	36,190,180	40,816,064
1943	28,490,000	3,703,700	4,843	726,450	199,233	39,225,222	43,847,216

[1] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

[2] Includes placer gold as follows: 1939, 413 ounces; 1940, 452 ounces; 1941, 203 ounces; 1942, 69 ounces; 1943, 12 ounces.

[3] Placer silver did not exceed 35 ounces in any year during the 4-year period ended with 1942, and none was produced in 1943.

[4] Revised figure, resulting from revision of New Jersey total ore from 643,766 to 607,766 tons.

Gold.—Iron (magnetite-pyrite-chalcopyrite) ore from the Cornwall mine in Lebanon County, Pa., yielded 77 percent of the total Eastern States gold output in 1943; the gold was contained in copper concentrates shipped to the smelting and electrolytic-refining plant at Laurel Hill, N. Y. Small quantities of gold were recovered from copper-iron ore from the Tennessee Copper Co. mines in Polk County, Tenn., and the Fontana mine in Swain County, N. C.; and from zinc-lead ore from the Valzinco mine in Spotsylvania County, Va. The only output of gold ore was 156 tons shipped from Smyrna, S. C. In Georgia 12 ounces of placer gold were produced. The estimated output of gold in the Southern Appalachian States from 1799 to 1943 is recorded as follows:

Mine production of gold in the Southern Appalachian States, 1799–1943

State	Period	Fine ounces	Value	State	Period	Fine ounces	Value
Alabama	1830–1943	49, 489	$1, 198, 775	South Carolina	1829–1943	318, 801	$7, 562, 125
Georgia	1830–1943	870, 521	18, 084, 082	Tennessee	1831–1943	20, 500	465, 130
Maryland	(1) –1943	6, 102	163, 940	Virginia	1828–1943	167, 414	3, 572, 469
North Carolina	1799–1943	1, 164, 567	24, 327, 108				
				Total	1799–1943	2, 597, 394	55, 373, 629

[1] Year of first production not recorded.

Silver.—The silver output of the Eastern States in 1943 was recovered as a byproduct of the mining of other metals. Copper-iron and copper ores from North Carolina, Tennessee, and Vermont yielded slightly more than 48 percent of the total silver, zinc-lead ore from New York and Virginia 41 percent, and iron (magnetite-pyrite-chalcopyrite) ore from Pennsylvania 10 percent; only 135 ounces were recovered from gold ore.

Copper.—Mines contributing to the output of copper in the Eastern States in 1943 were the Bethlehem Steel Co. Cornwall mine in Lebanon County, Pa., which yields copper, cobalt, gold, and silver as byproducts of iron mining; the North Carolina Exploration Co. Fontana copper-iron mine and the North Carolina Mining Co. Hazel Creek copper-(zinc) mine in Swain County, and a prospect in Mecklenburg County, N. C.; the Tennessee Copper Co. copper-iron sulfide mines in Polk County, Tenn.; the Valzinco zinc-lead mine (yielding byproduct copper, silver, and gold) in Spotsylvania County, Va.; the Vermont Copper Co. copper mine in Orange County, Vt.; and the Terry gold mine in York County, S. C., which yields a little copper recovered from gold ore. As the three principal copper-producing mines are in different States (North Carolina, Pennsylvania, and Tennessee), it is not possible to show the production separately by States without disclosing that of individual mines; the combined output of the three States is shown under Tennessee in the following table. The total output of copper in the Eastern States varied little from 1942; final figures show an increase of 0.3 percent in 1943. A decrease in Pennsylvania was offset by an increase in Tennessee and by output after October 1 from the reopened Elizabeth copper mine in Vermont.

Lead.—The lead output in the Eastern States is derived chiefly from zinc-lead sulfide ore, of which 905,634 tons were mined in 1943 compared with 846,820 tons in 1942. The straight lead ore mined in 1943 totaled 2,666 tons of carbonate, all from the Embree mine in Tennessee. Producers of zinc-lead ore were the Balmat mine in New York, the Austinville and Valzinco mines in Virginia, and the Bunche's Hollow and George Blow mines in Tennessee. Some of the lead concentrates from Virginia were shipped to the El Paso (Tex.) smelter, and a zinc-lead concentrate derived from lead cleaner tails at one of the mills was shipped to the Tooele (Utah) smelting and slag-fuming works. The output of recoverable lead decreased 79 tons from 1942 in New York and 38 tons in Tennessee but increased 485 tons in Virginia.

Zinc.—The ability of the mining companies to maintain zinc production in the Eastern States at nearly the record high level of 1942 was an important factor in supplying adequate quantities of zinc for war uses. The proximity of the mines to smelters and manufacturing centers enhances their value as a dependable source of zinc. In 1941 and 1942 mines in the Eastern States yielded 26 percent of the United States total mine output of zinc. The producing mines in New Jersey, New York, and Virginia were the same in 1943 as in 1942, except for the small shippers of carbonate or silicate ore in Virginia. In Tennessee the American Zinc Co. began producing from two newly developed mines during the year, making five mines operated in the State by that company. Production was hampered by labor shortage, and the total output of zinc from the company mines was less than in 1942. The Universal Exploration Co., the other large Tennessee producer, maintained output at approximately the same level in both years. The reserves of zinc ore in Tennessee are reported ample for sustained production over a considerable period, but the mines cannot operate at capacity in 1944 unless the shortage of labor that prevailed in the early part of the year is relieved. Production of recoverable zinc in New Jersey and New York was nearly the same as in 1942, but that in Virginia increased 16 percent. The remarkable performance of the zinc mines in the Eastern States under war conditions is shown by figures given by James Douglas, Director, Zinc Division, War Production Board, in an address at the twenty-sixth annual meeting, American Zinc Institute, Inc., St. Louis, Mo., April 17, 1944. The figures, which cover the period from October to December 1943, inclusive, show that only 5.4 percent of the recoverable zinc produced in the Eastern States came from B and C quota mines and that the average price paid per pound of zinc from A, B, and C quota mines was 8.87 cents; in the Western States 16.3 percent of the zinc came from B and C quota mines, and the average price was 10.54 cents; and in the Tri-State district (Kansas, Oklahoma, and Southwestern Missouri) 68.2 percent came from B and C quota mines, and the average price paid was 13.08 cents.

MINE PRODUCTION BY STATES

Mine production of gold, silver, copper, lead, and zinc in the Eastern States in 1943, by States, in terms of recovered metals

State	Mines producing		Ore (short tons)	Gold			Silver		
				Fine ounces		Total value	Fine ounces		Total value
	Lode	Placer		Lode	Placer		Lode	Placer	
Georgia		3			12	$420			
New Jersey	2		602,646						
New York	3		513,945				38,004		$27,025
North Carolina	3		24,332	131		4,585	7,169		5,098
Pennsylvania	1		(1)	2,218		77,630	13,095		9,312
South Carolina	1		156	147		5,145	135		96
Tennessee	15		2,525,785	303		10,605	52,058		37,019
Vermont	1		17,046	17		595	2,721		1,935
Virginia	3		528,051	50		1,750	14,947		10,629
	29	3	[2] 4,211,961	2,866	12	100,730	128,129		91,114
Total, 1942 [3]	36	17	[2] [4] 4,130,226	14,630	69	514,465	105,305	2	74,885

State	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
Georgia							$420
New Jersey					92,864	[5] $16,249,518	[5] 16,249,518
New York			2,355	$353,250	46,000	9,936,000	10,316,275
North Carolina	(6)	(6)					[7] 9,683
Pennsylvania	(6)	(6)					[7] 86,942
South Carolina	1,000	$130					5,371
Tennessee	[6] 27,709,000	[6] 3,602,170	200	30,000	41,766	9,021,456	[8] 12,701,250
Vermont	580,000	75,400					77,930
Virginia	200,000	26,000	2,288	343,200	13,603	4,018,248	4,399,827
	28,490,000	3,703,700	4,843	726,450	199,233	39,225,222	43,847,216
Total, 1942 [3]	28,404,000	3,436,884	4,475	599,650	199,809	36,190,180	40,816,064

[1] Ore is magnetite-pyrite-chalcopyrite, flotation copper concentrates from which yielded gold, silver, and copper; Bureau of Mines not at liberty to publish figures for ore and copper.

[2] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

[3] Includes output from Alabama, as follows: 1 lode mine; ore treated, 35 tons; gold produced, 1 ounce; value, $35. No production from Vermont in 1942.

[4] Revised figure, resulting from revision of New Jersey total ore from 643,766 to 607,766 tons.

[5] Estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.

[6] North Carolina and Pennsylvania included under Tennessee; Bureau of Mines not at liberty to publish separate figures.

[7] Excludes value of copper, which is included under Tennessee.

[8] Includes also value of copper from North Carolina and Pennsylvania.

MINING INDUSTRY

Important war-stimulated expansions in copper, lead, and zinc mining in the Eastern States in 1942 and 1943 were accomplished by broadening the scope of operations at developed and equipped mines. New operations contributing worthwhile quantities of metal were the reopened Valzinco zinc-lead mine in Virginia, equipped during 1942 with a 100-ton mill and operated throughout 1943; two newly developed American Zinc Co. zinc mines in eastern Tennessee, which began shipping ore to the company Mascot mill in 1943; the reopened Elizabeth copper mine in Vermont, which was equipped with a new mill and began operating October 1, 1943; and the reopened Hazel Creek copper mine in North Carolina, which shipped crude ore to smelters during most of 1943. The Bureau of Mines examined old copper, lead, and zinc mines, prospects, and mineralized areas throughout the Eastern States and did exploratory diamond drilling at places considered favorable for developing ore reserves. Properties explored, besides those mentioned in the following Review by States, included the old Stone Hill copper property in Cleburne and Randolph Counties, Ala.; the Cape Rosier zinc property at Harborside, Me.; and the Ore Hill zinc property at Warren, N. H. The only activity in lode-gold mining in the Eastern States in 1943 was a small-scale operation near Smyrna, S. C.; a little placer gold was recovered in Lumpkin and Union Counties, Ga. The quantity of the various types of ore mined in the Eastern States is shown in the table that follows.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in the Eastern States in 1943, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (short tons)	Zinc (short tons)
Dry and siliceous gold ore	156	147	135	1,000		
Copper ore	1,060,458	451	61,948	[1] 28,289,000		(2)
Magnetite-pyrite-chalcopyrite ore	(3)	2,218	13,095	(1)		
Lead ore	2,666				155	
Zinc ore	2,243,047					145,619
Zinc-lead ore	905,634	50	52,951	200,000	4,688	[2] 53,614
Total, lode mines	[4] 4,211,961	2,866	128,129	28,490,000	4,843	199,233
Total, placers		12				
	[4] 4,211,961	2,878	128,129	28,490,000	4,843	199,233
Total, 1942	[5] 4,130,226	14,699	105,307	28,404,000	4,475	199,809

[1] Copper from magnetite-pyrite-chalcopyrite ore included with that from copper ore.

[2] Zinc from copper ore included with that from zinc-lead ore; Bureau of Mines not at liberty to publish separate figures.

[3] Bureau of Mines not at liberty to publish separate figures for ore and copper.

[4] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

[5] Revised figure, resulting from revision of New Jersey zinc ore from 643,766 to 607,766 tons.

METALLURGIC INDUSTRY

The methods of treatment used in the various mills in the Eastern States and other operating details, including tonnage and grade of concentrates produced at some of the mills, are given in the Review by States that follows. Most of the concentrates are shipped to smelters operated by the companies that own the mines. The small quantity of gold ore mined in 1943 was shipped crude to a smelter, and no amalgamation or cyanidation mills were operated. Twelve ounces of placer gold were recovered by hand methods. Direct-smelting ore (165,868 tons) yielded 505 ounces of recoverable gold and 46,347 ounces of silver in 1943, and concentrates smelted (82,017 tons) yielded 2,361 ounces of gold and 81,782 ounces of silver; the figures for ore and concentrates do not include material containing no recoverable gold or silver. The totals for direct-smelting ore and concentrates were 166,175 and 742,499 tons, respectively.

REVIEW BY STATES

GEORGIA

Mines in Georgia produced no silver, copper, lead, or zinc in 1943. Two ounces of gold were recovered by individuals placer mining in Lumpkin County, and 10 ounces were found in a creek bed in Union County while rock was being taken out to crush for road work.

NEW JERSEY

Crude zinc ore mined in New Jersey in 1943 totaled 602,646 tons yielding 92,864 tons of recoverable zinc as metal or in oxide compared with 607,766 (revised figure) and 94,040 tons, respectively, in 1942. The producing mines in both years were the mine Hill at Franklin and the Sterling Hill at Ogdensburg, Sussex County. The commercial ore minerals comprise chiefly franklinite and willemite but also include zincite. Each mine is equipped with a mill. In the reduction of the ore the franklinite (a zinc-iron-manganese mineral) is removed from the crushed ore by magnetic separators, and the willemite and zincite are concentrated on jigs and tables. The concentrates are shipped to smelting and manufacturing works at Palmerton, Pa. The franklinite is used in the manufacture of zinc oxide and spiegeleisen, and the willemite-zincite concentrate is smelted to produce high-grade slab zinc.

The value of the New Jersey output of zinc given in the table of this chapter under the heading Mine Production by States is the combined value of the zinc recoverable in both metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

New Jersey has a few deposits of copper ore, but none has been worked for many years. Copper and lead smelters and refineries at Carteret and Perth Amboy treat ores, scrap, byproducts, and bullion from various States and foreign countries.

NEW YORK

The silver, lead, and zinc produced in New York come from a small area in St. Lawrence County east and southeast of Gouverneur. The yearly production from 1928 to 1942, inclusive, is given in the preceding report of this series (Minerals Yearbook, 1942, p. 356); previous records year by year are found in Mineral Resources of the United States, the annual publication that antedates Minerals Yearbook. Most of the output in 1943, as in other recent years, was produced by the Balmat and Edwards mines of the St. Joseph Lead Co. In response to the need for expanding domestic mine output of zinc for war purposes, the company increased output materially in 1941 and again in 1942, and the 1942 rate was maintained in 1943. The Balmat ore contains zinc, iron, and lead sulfides, and some silver is associated with the lead; it is mined through a 2,655-foot inclined shaft (vertical depth, about 1,300 feet) and treated in the 1,200-ton selective flotation plant at the mine. The mill feed in 1943 totaled 359,944 tons; it yielded 3,941 tons of lead concentrates containing 60.99 percent lead and 10.72 ounces of silver to the ton, 64,659 tons of zinc concentrates containing 55.96 percent zinc, and 70,456 tons of pyrite concentrates containing 40.92 percent iron and about 49 percent sulfur. The Edwards mine was operated through a vertical shaft 1,560 feet deep and an underground shaft (inclined 42° from horizontal) 1,226 feet to the mine workings. Ore treated totaled 133,965 tons yielding 23,695 tons of zinc concentrates containing 59.28 percent zinc. The zinc concentrates from both mills were shipped to the company smelter at Josephtown, Pa.; the lead concentrates from the Balmat mill were shipped to the company Herculaneum (Mo.) smelter. The pyrite concentrates were sold to sulfuric acid plants. During January the Universal Exploration Co. continued development work at its Hyatt zinc mine near Emeryville; production was suspended in August 1942. Mining and milling were resumed in February 1943 and continued throughout the year; the concentrates were shipped to the Donora (Pa.) smelter. At the Parker-Webb properties near Gouverneur, controlled by the Northern New York Mining Corporation, the Bureau of Mines completed a diamond-drilling project, and the corporation sank about 80 feet of shaft.

There are no zinc or lead smelters in New York. The Phelps Dodge Refining Corporation has a custom copper smelter and an electrolytic refinery at Laurel Hill which treat copper ore, matte, bullion, and copper-bearing scrap material.

NORTH CAROLINA

Since the closing of the Condor (old Howie) mine near Waxhaw in Union County and several smaller gold mines in other parts of North Carolina in the latter part of 1942, the only gold output in the State has been a small quantity recovered from copper ore; the output from this source was 131 ounces in 1943 compared with 4,077 ounces from all sources in 1942. As gold ores yielded a large part of the silver produced in the State in 1942, the output of this metal also decreased in 1943, totaling 7,169 ounces compared with 8,259 ounces in 1942. The Fontana copper mine in Swain County, which has been producing steadily since 1926 and has been operated by the North Carolina Exploration Co. since February 1, 1931, continued to operate throughout 1943 but was closed early in 1944. The mine is opened by a 2,670-foot inclined shaft. The ore is copper-iron sulfide and is shipped crude to Tennessee Copper Co. plants at Copper Hill, Tenn. Less copper was produced in 1943 than in 1942. It is expected that the mine will be flooded some time in 1944 by backwater from the Fontana Dam on the Little Tennessee River. The North Carolina Mining Co. shipped crude ore from the Hazel Creek (old Adams) mine near Proctor in Swain County to the U. S. Metals Refining Co. smelter at Carteret, N. J., from April through December 1943. Although considerable prospecting and development had been done on this property before 1943, little ore was produced. The company obtained a Reconstruction Finance Corporation loan and did exploratory work to determine whether ore reserves warranted construction of a mill. The ore shipped in 1943 averaged about 10 percent copper, 5 percent zinc, and 0.25 percent lead and 0.01 ounce of gold and 1.3 ounces of silver to the ton. A 25-ton flotation mill was being constructed in January 1944. Terry & Knowlton shipped a car of 3-percent copper ore containing some gold and silver from its property near Charlotte, Mecklenburg County. The Haywood Mining Corporation did prospecting under a Reconstruction Finance Corporation loan at its lead property near Canton, Haywood County, and the Bureau of Mines did exploratory diamond drilling at the Union Copper mine in Cabarrus and Rowan Counties.

PENNSYLVANIA

The Cornwall mine in Lebanon County, operated by the Bethlehem Steel Co., is a long-time producer of magnetite ore and since 1908 has yielded important quantities of copper, gold, and silver as byproducts; during the past few years cobalt has also become an important byproduct. The mine is developed by an open pit and three inclined shafts 1,700 feet deep. The principal ore minerals are magnetite, pyrite, and chalcopyrite. The ore is crushed to about 1-inch size at the shafts in Cornwall and shipped in standard hopper-bottom railroad cars to the combined magnetic concentration and flotation mill at Lebanon. The magnetic concentration equipment has a daily capacity of 6,500 tons and the flotation equipment 2,800 tons. In addition, a 2,400-ton sintering plant handles magnetic concentrates. The flotation equipment treats tailings from the magnetic separators for the recovery of copper concentrates which contain most of the gold and silver, and pyrite concentrates which contain cobalt. The copper concentrates are shipped to the Phelps Dodge smelter and electrolytic refinery at Laurel Hill, N. Y., and the pyrite concentrates to chemical plants.

Although no zinc has been produced in Pennsylvania in recent years, according to Arthur Winslow [1] extensive zinc mining was done in the Friedensville district, Lehigh County, from 1853 to 1876. From September 1943 to January 1944 the Bureau of Mines did exploratory diamond drilling on the Correll property in this district.

Pennsylvania zinc smelters at Donora, Langeloth, Josephtown, and Palmerton treat the largest part of the zinc concentrates produced in the Eastern States, as well as large tonnages from the Central States and foreign countries. There is a roasting plant for concentrates at New Castle and an electrogalvanizing plant for sheets at Johnstown that uses roasted zinc concentrates.

SOUTH CAROLINA

The wartime shut-down of the old Haile mine in Lancaster County, principal producer of gold in South Carolina and the Eastern States from 1937 to 1942, inclusive, continued throughout 1943. E. R. Vreeland shipped 156 tons of gold ore containing some silver and copper from the Terry mine near Smyrna, York County, to the U. S. Metals Refining Co. smelter at Carteret, N. J.

TENNESSEE

The 7-year period of steady annual increases in zinc production in Tennessee which began in 1936 ended in 1943 with a 5-percent decrease from 1942. Shortage of labor resulting chiefly from migration of miners to higher paid jobs in newly created war industries prevented capacity operation of several large mines in 1943. Lead output in the State also decreased, but the quantity produced in both 1942 and 1943 was small. All the State output of copper, gold, and silver and some of the zinc came from mines of the Tennessee Copper Co., which has operated continuously in the Ducktown district, Polk County, since 1899. In 1943 the company operated the Burra Burra, Eureka, Boyd, and Calloway mines, the London and Isabella selective flotation mills, the Copperhill smelter, sulfuric acid plants, and a copper sulfate plant. The mines are opened by vertical shafts, one of which is 2,400 feet deep. Development done in 1943 totaled 1,052 feet of air shaft, 21,763 feet of drifts, and 16,601 feet of diamond drilling. The ore contains sulfides of iron, copper, and zinc, carrying a little gold and silver. The iron concentrates produced in the mills were roasted to eliminate the sulfur for use in making sulfuric acid, and the resulting calcines were sintered and sold to iron and steel producers, mostly in the Birmingham (Ala.) district. The zinc concentrates were sold to the Donora (Pa.) smelter. The copper concentrates were treated in the reverberatory furnace at the Copperhill plant without preliminary roasting. Copper-iron sulfide ore from the Fontana mine in Swain County, N. C., was also treated. A considerable quantity of crude ore was shipped direct from the company mines to the smelter for treatment in the blast furnace, and a small tonnage went direct to the reverberatory. Most of the blister copper from the converter was cast into pigs and shipped to an electrolytic refinery on the Atlantic seaboard, where some gold and silver were recovered as byproducts. Shot copper was produced for use in the copper sulfate plant.

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[1] Winslow, Arthur, Lead and Zinc Deposits: Missouri Geol. Survey, vol. 6, 1894, p. 121.

Mines in Knox and Jefferson Counties continued to yield most of the State output of zinc. In 1943 the American Zinc Co. of Tennessee operated the Mascot No. 2, Grasselli, and Jarnagin mines throughout the year, the newly developed Athletic (Mossy Creek) mine (called Carson Newman (Athletic Field) in the report of this series for 1942) at Jefferson City from June, and the Shallow Ore open-pit mine at New Market from October to the end of the year. The ore from all five mines was concentrated in the company mill at the Mascot No. 2 mine, which has a capacity of about 4,000 tons daily and is equipped with a differential-density cone unit, jigs, and flotation machines. Ore milled totaled 1,209,992 tons, from which 52,292 tons of concentrates averaging 61.06 percent zinc were produced. In 1942 the mill produced 55,831 tons of concentrates. All the mines are fully mechanized, and slushing is the principal method of underground loading. The annual company report to stockholders contains the following data on mine development and ore reserves: Prospecting for ore extensions and development at the four underground mines totaled 32,466 feet of surface churn drilling, 48,894 feet of surface diamond drilling, 13,516 feet of underground diamond drilling, and 5,524 feet of drifts and raises. Prospecting on optioned properties in Knox County consisted of 8,011 feet of surface diamond drilling, in Jefferson County 7,262 feet of surface churn drilling and 2,340 feet of surface diamond drilling, and in Monroe County 889 feet of surface diamond drilling; this drilling did not result in finding commercial ore. The company proved and indicated ore reserves in Tennessee at the end of 1943 were approximately 42 percent greater than on January 1, 1940. The marginal ore reserves on the new Shallow Ore mine are not included in the normal ore reserves.

The Universal Exploration Co. operated its Davis mine group and 800-ton flotation mill at Jefferson City steadily; the output of zinc sulfide concentrates was approximately the same as in 1942. The concentrates were shipped to the Donora (Pa.) smelter. The small gravity-concentration mill on the property, used occasionally for treating carbonate ores, was not run in 1943. The Lacy-Butler Co. shipped 272 tons of 40-percent zinc silicate from the Finchem mine. The Embree Iron Co. operated its zinc and lead carbonate mines in Washington and Unicoi Counties near Embreeville on a small scale from January to August. During the summer of 1943 the company sold its entire holdings in the Embreeville area—including zinc, lead, and manganese mines, mining equipment, and mills—to the Tennessee Zinc Co., which devoted most of its efforts the rest of the year to reworking manganese tailings and remodeling a mill. The Bureau of Mines did exploratory diamond drilling on the property late in 1943, followed by churn drilling by the company. The company plans to do strip mining in 1944. The Embree Iron Co. continued as agent for the Metals Reserve Co., stimulating production of manganese ore in the Appalachian region and purchasing ore for the stock pile at Elizabethton, Tenn. In Claiborne County the Imperial Mining Co. operated the Bunche's Hollow mine 2 miles northwest of Goin during part of 1943 and installed flotation equipment in the mill; shipments in the latter part of the year included both lead and zinc concentrates. George Blow continued to ship zinc-lead ore from his mine in Union County to the flotation mill at the Austinville (Va.) mine. Dr. Gant Gaither shipped 58-percent zinc concentrates from his small jig mill at the Hoover mine 10 miles northeast of Murfreesboro. The Bureau of Mines did diamond drilling on the Eve's Mill zinc property in Monroe County; the results obtained warranted further investigation, and geologists of the American Zinc Co., which had previously drilled on the property, and the Federal Geological Survey began preparing a detailed map, showing the structural relations of the ore deposits in the area, to be used in making plans for additional development.

VERMONT

In 1943 the Vermont Copper Co. completed work begun in 1942 on reequipping the old Elizabeth mine in Orange County, including construction of a 500-ton flotation mill, and was in production from October 1 through December. The mine was reopened under a contract with the Metals Reserve Co., to which all the copper produced for 2½ years is to be delivered. The last previous operation was by the National Copper Corporation, which closed the mine in June 1930 owing to the low price of copper. The ore minerals are chalcopyrite and pyrrhotite, carrying some silver and a little gold. The mine is developed by a 1,200-foot adit, an underground 30° inclined shaft 750 feet long, and four main levels opening up the vein, which has a strike length of 1,000 feet. The broken ore is hauled by underground tram to loading chutes on the adit at the top of the underground shaft and from there to the mill by an electric locomotive in Granby-type ore cars of 5-ton capacity. In 1943 the mill heads averaged 2.17 percent copper. The concentrates produced (1,584 tons) contained 19.05 percent copper and 1.7 ounces of silver and 0.01 ounce of gold to the ton; they were shipped to the Phelps Dodge smelter at Laurel Hill, N. Y.

VIRGINIA

The annual production of gold, silver, copper, lead, and zinc in Virginia from 1928 to 1942, inclusive, is given in the preceding report of this series (Minerals Yearbook, 1942, p. 361); previous records year by year are found in Mineral Resources of the United States. No gold mines were operated in the State in 1943, but some gold, as well as silver and copper, was recovered from zinc-lead ore. The output of zinc and lead from the Austinville mine in Wythe County—a large steady producer since 1927—exceeded that in 1942. The ore was treated in the 2,000-ton selective flotation mill at the mine. The mill also handled small tonnages of purchased crude ore monthly. The Valzinco mine near Paytes in Spotsylvania County, reopened by Panaminas, Inc., in 1942 and equipped with a 100-ton selective flotation mill, was operated steadily throughout 1943. The mine is opened by a 250-foot shaft and a 120-foot winze. Development done in 1943 comprised 766 feet of drifts, a 176-foot raise, and 4,213 feet of diamond drilling. The mill products are zinc concentrates, lead concentrates, and zinc-lead concentrates (from lead cleaner tails), all containing a little silver, copper, and gold. The zinc concentrates were shipped to the Langeloth (Pa.) smelter, the lead concentrates to the El Paso (Tex.) smelter, and the zinc-lead concentrates to the International (Utah) lead smelter and slag-fuming plant. The Bureau of Mines did exploratory diamond drilling on the Panaminas properties from July to the end of the year; other Virginia properties drilled by the Bureau were the Toncrae-Howard (in Floyd County) and the Virgilina (Durgy) (in Halifax County) copper properties.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO

(MINE REPORT)

By G. E. WOODWARD AND PAUL LUFF

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SUMMARY

The total value of gold, silver, copper, lead, and zinc produced by Idaho mines was $43,199,910 in 1943 compared with $46,063,326 in 1942—a 6-percent decrease (see fig. 1). The value of the gold output was $1,078,280 (3 percent of the State total), silver $8,320,128 (19 percent), copper $604,240 (1 percent), lead $14,468,550 (34 percent), and zinc $18,728,712 (43 percent). The quantity of each metal produced was less than in 1942; however, the value of the zinc output was greater, owing to the higher average price of the metal. Compared with 1942 gold production decreased nearly 68 percent, silver 20, copper 32, lead 15, and zinc nearly 1 percent. In 1943 Idaho was the largest producer of silver, antimony, and tungsten in the United States and the largest producer of lead and zinc in the Western States.

Production of copper, lead, and zinc in Idaho in 1943 was affected by the following factors: An acute shortage of labor, which persisted throughout the year; the discovery in June of high-grade lead-silver ore in the Chester vein of the Sunshine property near Kellogg; completion in April of the Bunker Hill & Sullivan zinc slag-fuming plant at Bradley and the Hecla 2,000-ton zinc-lead tailing plant at Osburn; and the marked decrease in output of zinc-lead-silver ore from the Hecla mine at Burke.

Premium payments for overquota production of copper, lead, and zinc were in force throughout 1943; however, the War Production Board announced October 27 that premium payments in the B range had been denied to lead mines not already operating and to lead mines having a low labor productivity and located in areas in which there is a serious labor shortage; that premium payments in the B and C ranges had been denied to zinc mines not already operating and to zinc mines having a low labor productivity and located in areas in which there is a serious labor shortage; and that the Government is not now financing new zinc projects. It announced November 9 that no applications would be considered after December 31, 1943, for special copper premium prices. The Board stated that these curtailments for lead and zinc premium payments were necessary owing to increased mineral production, revised military requirements, and a greater need for manpower in the larger producing mines; that curtailments in copper premium prices were due to the balancing of copper supplies with military needs and essential civilian requirements.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of January 31, 1934. Treasury legal coinage value of gold from January 18, 1837, to January 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1939–43, and total, 1863–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	362	465	2,108,445	116,662	$4,083,170	17,222,370	$11,690,336
1940	378	548	2,556,687	146,480	5,126,800	17,552,240	12,481,593
1941	331	524	2,704,686	149,816	5,243,560	16,672,410	11,855,936
1942	203	236	2,900,704	95,020	3,325,700	14,644,890	10,414,144
1943	127	30	2,741,747	30,808	1,078,280	11,700,180	8,320,128
1863-1943			(1)	7,754,986	174,563,913	495,920,027	340,934,359

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	5,032,000	$523,328	181,962,000	$8,552,214	95,098,000	$4,945,096	$29,794,144
1940	6,698,000	756,874	209,668,000	10,483,400	141,202,000	8,895,726	37,744,393
1941	7,242,000	854,556	209,828,000	11,960,196	158,168,000	11,862,600	41,776,848
1942	6,860,000	830,060	227,818,000	15,263,806	174,512,000	16,229,616	46,063,326
1943	4,648,000	604,240	192,914,000	14,468,550	173,414,000	18,728,712	43,199,910
1863-1943	[2] 103,513	31,747,047	[2] 5,728,420	617,663,418	[2] 1,047,330	153,751,611	1,318,660,348

[1] Figures not available.

[2] Short tons.

Gold and silver produced at placer mines in Idaho, 1939–43, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating [1]		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1939	5,443	1,638	196	26	4,475	1,332	9,576	4,389	28,973	7,490	48,663	14,875
1940	6,664	1,337	291	48	5,623	758	6,569	5,427	41,262	10,226	60,409	17,796
1941	4,809	1,149	228	46	3,185	388	11,725	2,100	52,358	13,725	72,395	17,408
1942	1,197	234	83	7	563	60	6,126	879	36,611	9,291	44,580	10,471
1943	249	69	6	------	------	------	------	------	------	------	255	69

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline floating dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

Gold.—The output of recoverable gold in Idaho was nearly 68 percent less in 1943 than in 1942. This decrease, which resulted from the closing in 1942 of most of the large lode producers and all the large placer producers, was caused principally by the gold-mine closing order issued by the Government in October 1942. The yield of gold from lode mines decreased from 50,440 ounces in 1942 to 30,553 ounces in 1943 and that from placers from 44,580 to 255 ounces. The output of gold from placers was the smallest ever recorded in the history of the State. About 53 percent of the State total gold in 1943 came from siliceous gold ore, more than 26 percent from zinc-lead ore, and nearly all the remainder from siliceous gold-silver ore. In 1942 dredging operations (chiefly bucket-line dredges) recovered 43,300 ounces (nearly 46 percent) of Idaho's gold output; no dredges operated in 1943. As a result of the idleness of dredges, gold production decreased sharply in 1943 in the Boise Basin, Yankee Fork, Middle Boise, Elk City, Hoodoo, Gibbonsville, Warren, and Orogrande districts. Gold output from lode mines slumped in the Middle Boise, Carson, West View, Mineral Hill (Lemhi County), Burgdorf-Marshall Lake, Ten Mile, Boise Basin, Thunder Mountain, and Yankee Fork districts. In 1943 nearly half of the State gold output came from a lode mine in the Middle Boise (Atlanta) district.

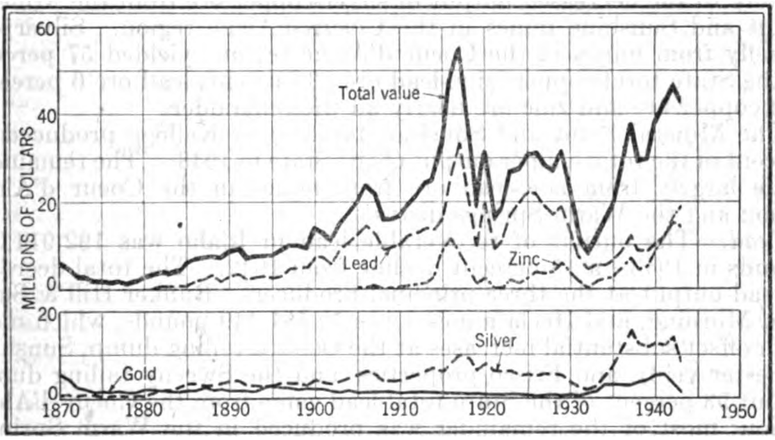

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Idaho, 1870–1943. The value of copper has been less than $2,000,000 annually, except in a few years.

Talache Mines, Inc., operating a lode property at Atlanta, was by far the largest gold producer in Idaho, although the output was 40 percent less in 1943 than in 1942; it was followed by the Triumph mine near Ketchum and the Yellow Pine mine at Stibnite. These three properties produced 81 percent of the State gold output in 1943.

Silver.—The output of recoverable silver in Idaho was 11,700,180 fine ounces in 1943—20 percent less than in 1942. A greater decrease was prevented by the discovery in June of high-grade lead-silver ore in the Chester vein of the Sunshine property near Kellogg. However, the total production of silver from this mine—leading silver producer in the United States—declined more than 1,000,000 ounces. Large decreases in silver output occurred also at the Mineral Point, Hecla, Polaris, De Lamar, Bunker Hill & Sullivan, Morning, Sherman, and

Crescent properties. The Coeur d'Alene region produced 88 percent of the State total silver in 1943; the remainder came largely from the Warm Springs, Bayhorse, Yellow Pine, Deadwood Basin, Blue Wing, Middle Boise, and South Mountain districts. Of the State total silver, zinc-lead ore yielded nearly 43 percent, silver ore 39 percent, lead ore nearly 16 percent, gold-silver ore and gold ore 2 percent, and other ores less than 1 percent. The yield of silver from silver ore decreased 2,932,814 ounces and from zinc-lead ore 357,302 ounces, but that from lead ore increased 716,016 ounces owing to the yield from the Chester vein.

Eight mines—the Sunshine, Bunker Hill & Sullivan, Mineral Point, Triumph, Hecla, Page, Morning, and Polaris—produced 79 percent of the silver output of the State during 1943. All these mines except the Triumph are in the Coeur d'Alene region.

Copper.—The output of recoverable copper in Idaho in 1943 was 4,648,000 pounds—32 percent less than in 1942. The loss was due mainly to the decreased output of silver-copper ore from the Mineral Point and Sunshine mines in the Coeur d'Alene region. Silver ore (chiefly from mines in the Coeur d'Alene region) yielded 57 percent of the State total copper, zinc-lead ore 33 percent, lead ore 6 percent, and copper ore and zinc ore nearly all the remainder.

The Mineral Point and Sunshine mines near Kellogg produced 57 percent of the total copper output of the State in 1943. The remainder came largely from zinc-lead ore from mines in the Coeur d'Alene region and the Warm Springs district.

Lead.—The output of recoverable lead in Idaho was 192,914,000 pounds in 1943—a 15-percent decline from 1942. The total decrease in lead output at the three principal producers—Bunker Hill & Sullivan, Morning, and Hecla mines—was 39,581,449 pounds, which more than offset substantial increases at the Osburn tailing dump, Sunshine (Chester vein), and Frisco properties, and the Sweeny tailing dump. About 93 percent of the State total lead came from the Coeur d'Alene region; most of the remainder was produced in the Warm Springs, Bayhorse, Port Hill, Deadwood Basin, and Pend d'Oreille districts. Zinc-lead ore and old tailings from the Coeur d'Alene region yielded 81 percent of the State total lead; and lead ore, chiefly from the Coeur d'Alene region, yielded nearly 13 percent. Lead recovered from zinc-lead ore and old tailings decreased 27,391,752 pounds and from lead ore 7,598,222 pounds.

In 1943 the combined lead output of the three largest producers—the Bunker Hill & Sullivan, Morning, and Hecla—was 91,637,688 pounds (131,219,137 pounds in 1942), or more than 47 percent of the State total; other important producers were the Page, Star, Tamarack, Sherman, Triumph, Sunshine (Chester vein), Frisco, Dayrock, Osburn tailing dump, Clayton, and Gold Hunter properties.

Zinc.—The output of recoverable zinc in Idaho was 173,414,000 pounds in 1943—a decrease of nearly 1 percent from the record output of 1942. Marked declines in output of zinc from the Hecla, Morning, Triumph, and Star properties more than offset substantial increases from the Bunker Hill & Sullivan zinc slag-fuming plant, the Osburn tailing dump, and the Frisco, Tamarack, Page, Small Lease (old tailings), Monitor, Douglas, and Hall-Interstate properties. Nearly 92 percent of the State total zinc in 1943 came from the Coeur d'Alene region and nearly all the remainder from the Warm Springs, Deadwood Basin, South Mountain, Bayhorse, and Lava Creek districts. Zinc-lead ore and old tailings concentrated yielded 94 percent of the State total zinc, and zinc slag fumed yielded most of the remainder.

Nine properties—the Star, Morning, Bunker Hill & Sullivan (mine), Tamarack, Bunker Hill & Sullivan zinc slag-fuming plant, Page, Triumph, Hecla, and Frisco—produced 84 percent of the State total zinc in 1943.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Adams	2		9	$315	959	$682
Benewah		1	8	280		
Blaine	20		6,711	234,885	730,291	519,318
Boise	7	6	406	14,210	5,642	4,012
Bonner	4		10	350	17,529	12,465
Bonneville		1	17	595		
Boundary	2		622	21,770	19,461	13,839
Butte	2		75	2,625	21,863	15,547
Camas	5		198	6,930	2,859	2,033
Cassia	1				14	10
Clark	1				76	54
Clearwater		5	12	420		
Custer	12	1	283	9,905	212,840	151,353
Elmore	4	1	13,923	487,305	45,571	32,406
Gem	1		60	2,100	1,956	1,391
Idaho	4	4	315	11,025	76	54
Latah		2	3	105		
Lemhi	9	1	39	1,365	53,031	37,711
Nez Perce		2	23	805	7	5
Owyhee	2	2	112	3,920	43,200	30,720
Shoshone	47	3	2,250	78,750	10,302,840	7,326,464
Valley	2	1	5,732	200,620	239,933	170,619
Washington	2				2,032	1,445
	127	30	30,808	1,078,280	11,700,180	8,320,128
Total, 1942	203	236	95,020	3,325,700	14,644,890	10,414,144

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams	37,200	$4,836					$5,833
Benewah							280
Blaine	353,800	45,994	7,362,000	$552,150	9,603,000	$1,037,124	2,389,471
Boise	400	52	10,000	750			19,024
Bonner	800	104	597,000	44,775	18,000	1,944	59,638
Bonneville							595
Boundary	13,600	1,768	830,000	62,250	224,000	24,192	123,819
Butte	4,300	559	397,000	29,775	348,000	37,584	86,090
Camas	2,500	325	10,000	750			10,038
Cassia			2,000	150			160
Clark			19,000	1,425			1,479
Clearwater							420
Custer	61,300	7,969	3,061,000	229,575	1,005,000	108,540	507,342
Elmore	100	13	4,000	300			520,024
Gem			23,000	1,725	19,000	2,052	7,268
Idaho							11,079
Latah							105
Lemhi	76,200	9,906	262,000	19,650			68,632
Nez Perce							810
Owyhee	63,800	8,294	78,000	5,850	1,266,000	136,728	185,512
Shoshone	3,974,000	516,620	179,626,000	13,471,950	159,268,000	17,200,944	38,594,728
Valley	56,000	7,280	632,000	47,400	1,663,000	179,604	605,523
Washington	4,000	520	1,000	75			2,040
	4,648,000	604,240	192,914,000	14,468,550	173,414,000	18,728,712	43,199,910
Total, 1942	6,860,000	830,060	227,818,000	15,263,806	174,512,000	16,229,616	46,063,326

Gold and silver produced at lode mines in Idaho in 1943, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver	County	Ore sold or treated	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*
Adams	88	9	959	Gem	183	60	1,956
Blaine	115,060	6,711	730,291	Idaho	1,269	211	52
Boise	395	371	5,632	Lemhi	28,554	36	53,031
Bonner	11,666	10	17,529	Owyhee	4,711	110	43,200
Boundary	16,860	622	19,461	Shoshone	2,270,385	2,238	10,302,840
Butte	4,268	75	21,863	Valley	197,681	5,730	239,933
Camas	532	198	2,859	Washington	107	----------	2,032
Cassia	3	----------	14				
Clark	54	----------	76		2,741,747	30,553	11,700,111
Custer	36,380	250	212,812	Total, 1942	2,900,704	50,440	14,634,419
Elmore	53,551	13,922	45,571				

Gold and silver produced at placer mines in Idaho in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating [1]		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Benewah	8	------	------	------	------	------	------	------	------	------	8	------
Boise	35	10	------	------	------	------	------	------	------	------	35	10
Bonneville	17	------	------	------	------	------	------	------	------	------	17	------
Clearwater	12	------	------	------	------	------	------	------	------	------	12	------
Custer	33	28	------	------	------	------	------	------	------	------	33	28
Elmore	1	------	------	------	------	------	------	------	------	------	1	------
Idaho	104	24	------	------	------	------	------	------	------	------	104	24
Latah	3	------	------	------	------	------	------	------	------	------	3	------
Lemhi	3	------	------	------	------	------	------	------	------	------	3	------
Nez Perce	23	7	------	------	------	------	------	------	------	------	23	7
Owyhee	2	------	------	------	------	------	------	------	------	------	2	------
Shoshone	6	------	6	------	------	------	------	------	------	------	12	------
Valley	2	------	------	------	------	------	------	------	------	------	2	------
	249	69	6	------	------	------	------	------	------	------	255	69
Total, 1942	1,197	234	83	7	[2] 563	[2] 60	[3] 6,126	[3] 879	[4] 36,611	[4] 9,291	44,580	10,471

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline floating dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

[2] Recovered from 75,362 cubic yards of gravel treated by 5 dry-land dredges.

[3] Recovered from 1,100,575 cubic yards of gravel treated by 7 dragline floating dredges.

[4] Recovered from 7,772,947 cubic yards of gravel treated by 10 floating bucket dredges.

MINING INDUSTRY

A labor shortage, which characterized the entire year, and the gold-mine closing order issued by the Government in October 1942 affected the mining industry in Idaho in 1943 more than any other factors. The shortage of labor became so acute during the summer months that zinc and lead production dropped; in consequence, the Army was called upon again to furlough soldiers to the critical metal-producing districts, especially to the zinc-lead mines in the Coeur d'Alene region. The output of zinc-lead ore and old tailings (by far the chief output of the State) increased 8 percent, and the output of gold-silver ore (178,749 tons) was slightly more than in 1942; but gold ore decreased 54 percent, silver ore 37 percent, and lead ore 24 percent.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Idaho in 1943, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	25	65,352	16,313	58,476	28,972	213,215	201,000
Dry and siliceous gold-silver ore	3	178,749	5,486	173,836	---------	---------	---------
Dry and siliceous silver ore	15	287,344	175	4,596,079	2,650,329	842,358	2,210
	43	531,445	21,974	4,828,391	2,679,301	1,055,573	203,210
Copper ore	8	329	24	8,515	67,025	2,247	---------
Lead ore	39	237,122	333	1,819,699	295,680	24,380,492	901,548
Lead-copper ore	1	68	1	8,172	5,015	21,500	---------
Zinc ore	4	[2] 44,382	58	46,806	64,650	737,300	8,634,182
Zinc-lead ore	49	1,928,401	8,163	4,988,528	1,536,329	166,716,888	163,675,060
Total, lode mines	[1] 127	2,741,747	30,553	11,700,111	4,648,000	192,914,000	173,414,000
Total, placers	30	---------	255	69	---------	---------	---------
	157	2,741,747	30,808	11,700,180	4,648,000	192,914,000	173,414,000
Total, 1942	439	2,900,704	95,020	14,644,890	6,860,000	227,818,000	174,512,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[2] Includes 39,465 tons of zinc slag.

METALLURGIC INDUSTRY

Of the 2,741,747 tons of ore produced in 1943 in Idaho, 2,669,059 tons (97 percent) were treated at concentration plants, 55,020 tons (2 percent) were treated at amalgamation mills, and 17,668 tons (1 percent) were shipped crude to smelters.

Concentration plants in 1943 treated 6,350 tons of gold ore, 178,747 tons of gold-silver ore, 276,865 tons of silver ore, 234,489 tons of lead ore, 4,801 tons of zinc ore, and 1,928,342 tons of zinc-lead ore. Although 55,976 tons of current hot slag and 23,482 tons of old dump slag were fumed in 1943, only the dump slag and 15,983 tons of the hot slag were credited directly to the fuming-plant operation; the remainder of the hot slag (39,993 tons) was credited to various producers of the ores and concentrates that contributed during the year to the slag-making material.

Ore treated at straight amalgamation mills in 1943 totaled 346 tons, and that at combined amalgamation and concentration plants, 54,674 tons; none was treated at cyanidation plants.

The Bunker Hill & Sullivan Mining & Concentrating Co. operated its Bradley lead smelter and refinery at near capacity in 1943 on ore and concentrates, chiefly from mines and mills in the Coeur d'Alene region. The company also operated its antimony and bismuth plant, 1,700-ton flotation mill (including sink-and-float unit), 300-ton tailing-treatment plant for recovery of iron and lead from old jig tailings, and 450-ton zinc slag-fuming plant at Bradley. The slag-fuming plant yielded 12,401 dry tons of deleaded zinc fume and 3,032 dry tons of lead fume. The Sunshine Mining Co. operated its electrolytic antimony plant (100-ton capacity) throughout the year on silver-copper-antimony concentrates from the Sunshine and Coeur d'Alene Mines milling plants. The Sullivan Mining Co. operated continuously at capacity its 100-ton electrolytic zinc plant near Bradley on zinc and zinc-lead concentrates and oxide zinc fume produced mainly from plants in the Coeur d'Alene region. Antimony, tungsten, and antimony-iron-gold concentrates were produced throughout the year in the 600-ton flotation mill of the Bradley Mining Co. at Stibnite, and tungsten concentrates and silver-copper-lead-iron concentrates in the Ima mill at Patterson.

Mine production of metals in Idaho in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	55,020	8,742	4,468			
Concentrates smelted	362,690	19,410	11,565,250	4,534,662	191,264,293	173,331,590
Ore smelted	17,668	2,401	130,393	113,338	1,649,707	82,410
Placer		255	69			
		30,808	11,700,180	4,648,000	192,914,000	173,414,000
Total, 1942		95,020	14,644,890	6,860,000	227,818,000	174,512,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Idaho in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Boise	330	205	72					
Elmore	53,424	8,445	4,385	810	4,710	38,860		
Idaho	1,266	92	11	20	109	20		
	55,020	8,742	4,468	830	4,819	38,880		
Total, 1942	109,072	16,580	8,531	1,685	11,826	105,101	1,300	400

CYANIDATION MILLS

Total: 1943	(1)							
1942	2,700	391	3,304	11	9	23		700
Grand total: 1943	55,020	8,742	4,468	830	4,819	38,880		
1942	111,772	16,971	11,835	1,696	11,835	105,124	1,300	1,100

[1] None treated at cyanidation mills in 1943.

Mine production of metals from concentrating mills in Idaho in 1943, by counties, in terms of recovered metals

County	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	109, 930	28, 009	5, 710	708, 097	331, 411	7, 261, 274	9, 579, 860
Bonner	11, 594	444	10	16, 453	800	508, 100	18, 000
Boundary	16, 860	1, 158	622	19, 461	13, 600	830, 000	224, 000
Butte	4, 117	1, 120	75	21, 593	4, 300	357, 000	348, 000
Custer	35, 670	3, 566	77	192, 589	39, 624	2, 911, 510	999, 000
Gem	183	65	60	1, 956	----------	23, 000	19, 000
Lemhi	27, 857	946	15	48, 216	60, 000	91, 000	----------
Owyhee	4, 706	2, 115	55	42, 407	63, 800	78, 000	1, 266, 000
Shoshone	2, 260, 461	311, 462	2, 237	10, 235, 665	3, 965, 127	178, 572, 409	159, 214, 730
Valley	197, 681	12, 975	5, 730	239, 933	56, 000	632, 000	1, 663, 000
	2, 669, 059	361, 860	14, 591	11, 526, 370	4, 534, 662	191, 264, 293	173, 331, 590
Total, 1942	2, 762, 323	405, 258	18, 814	14, 213, 958	6, 635, 494	221, 565, 460	173, 810, 377

Gross metal content of concentrates produced from ores mined in Idaho in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	3, 710	8, 302	70, 940	51	69	----------
Dry gold-silver	8, 027	2, 000	141, 322	----------	----------	----------
Dry silver	3, 240	31	153, 743	45, 600	21, 900	8, 000
Copper	4, 631	58	3, 950, 424	2, 545, 100	160, 000	----------
Lead	147, 132	3, 893	5, 958, 824	1, 301, 834	182, 449, 973	21, 383, 019
Lead-copper	1, 875	260	511, 073	247, 182	825, 842	151, 500
Zinc	159, 415	1, 447	580, 421	645, 898	9, 153, 279	172, 220, 926
Zinc-copper	800	30	32, 407	63, 300	73, 500	170, 000
Zinc-lead	15, 097	217	101, 556	48, 693	3, 517, 035	13, 342, 574
Dry iron (from zinc-lead ore)	18, 763	3, 172	64, 540	54, 374	1, 284, 330	1, 069, 728
	362, 690	19, 410	11, 565, 250	4, 952, 032	197, 485, 928	208, 345, 747
Total, 1942	406, 954	30, 649	14, 319, 082	7, 370, 983	230, 665, 469	215, 931, 812

Mine production of metals from Idaho concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	28,009	5,710	708,097	331,411	7,261,274	9,579,860
Bonner	444	10	16,453	800	508,100	18,000
Boundary	1,158	622	19,461	13,600	830,000	224,000
Butte	1,120	75	21,593	4,300	357,000	348,000
Custer	3,566	77	192,589	39,624	2,911,510	999,000
Elmore	810	4,710	38,860			
Gem	65	60	1,956		23,000	19,000
Idaho	20	109	20			
Lemhi	946	15	48,216	60,000	91,000	
Owyhee	2,115	55	42,407	63,800	78,000	1,266,000
Shoshone	311,462	2,237	10,235,665	3,965,127	178,572,409	159,214,730
Valley	12,975	5,730	239,933	56,000	632,000	1,663,000
	362,690	19,410	11,565,250	4,534,662	191,264,293	173,331,590
Total, 1942	406,954	30,649	14,319,082	6,636,794	221,566,560	173,810,377

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	3,710	8,302	70,940	49	41	
Dry gold-silver	8,027	2,000	141,322			
Dry silver	3,240	31	153,743	42,900	14,600	
Copper	4,631	58	3,950,424	2,440,900	80,000	
Lead	147,132	3,893	5,958,824	1,103,271	177,150,330	6,574,034
Lead-copper	1,875	260	511,073	204,000	791,422	
Zinc	159,415	1,447	580,421	595,377	8,576,456	154,477,326
Zinc-copper	800	30	32,407	53,800	70,400	108,000
Zinc-lead	15,097	217	101,556	44,472	3,376,400	11,976,080
Dry-iron (from zinc-lead ore)	18,763	3,172	64,540	49,893	1,204,644	196,150
	362,690	19,410	11,565,250	4,534,662	191,264,293	173,331,590

Gross metal content of Idaho crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	3,982	2,133	7,699	22,543	24,925	
Dry and siliceous gold-silver	2	6	482			
Dry and siliceous silver	10,479	48	37,421	8,086	649,510	
Copper	329	24	8,515	68,890	3,739	
Lead	2,633	186	66,653	13,377	1,053,859	11,274
Lead-copper	68	1	8,172	5,900	22,400	
Zinc	116	2	300	911	9,710	83,257
Zinc-lead	59	1	1,151	637	10,793	9,530
	17,668	2,401	130,393	120,344	1,774,936	104,061
Total, 1942	26,609	2,820	303,502	250,030	6,568,229	975,618

Mine production of metals from Idaho crude ore shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Adams	88	9	959	37, 200		
Blaine	5, 130	1, 001	22, 194	22, 389	100, 726	23, 140
Boise	65	166	5, 560	400	10, 000	
Bonner	72		1, 076		88, 900	
Butte	151		270		40, 000	
Camas	532	198	2, 859	2, 500	10, 000	
Cassia	3		14		2, 000	
Clark	54		76		19, 000	
Custer	710	173	20, 223	21, 676	149, 490	6, 000
Elmore	127	767	2, 326	100	4, 000	
Idaho	3	10	21			
Lemhi	697	21	4, 815	16, 200	171, 000	
Owyhee	5	55	793			
Shoshone	9, 924	1	67, 175	8, 873	1, 053, 591	53, 270
Washington	107		2, 032	4, 000	1, 000	
	17, 668	2, 401	130, 393	113, 338	1, 649, 707	82, 410
Total, 1942	26, 609	2, 820	303, 502	223, 206	6, 251, 440	701, 623

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	**3, 982**	**2, 133**	**7, 699**	**21, 923**	**15, 174**	
Dry and siliceous gold-silver	**2**	**6**	**482**			
Dry and siliceous silver	**10, 479**	**48**	**37, 421**	**7, 279**	**572, 170**	
Copper	**329**	**24**	**8, 515**	**67, 025**	**2, 247**	
Lead	**2, 633**	**186**	**66, 653**	**10, 746**	**1, 019, 586**	**8, 270**
Lead-copper	**68**	**1**	**8, 172**	**5, 015**	**21, 500**	
Zinc	**116**	**2**	**300**	**850**	**8, 400**	**67, 940**
Zinc-lead	**59**	**1**	**1, 151**	**500**	**10, 630**	**6, 200**
	17, 668	**2, 401**	**130, 393**	**113, 338**	**1, 649, 707**	**82, 410**

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Adams County: Seven Devils	2		88	9		9	959		959	37,200			$5,833
Benewah County:													
Tyson Creek (Camas Cove)		1			8	8							280
Blaine County:													
Lava Creek	1		1,069	5		5	1,416		1,416	900	25,000	118,000	15,918
Little Wood River	2		54				706		706	300	15,000	3,000	1,990
Mineral Hill and Camas	9		4,163	933		933	12,136		12,136	21,300	53,000	2,000	48,245
Sawtooth (Vienna)	1		24	2		2	959		959				752
Warm Springs	7		109,750	5,771		5,771	715,074		715,074	331,300	7,269,000	9,480,000	2,322,566
Boise County:													
Banner	(1)		1	1		1	59		59				77
Boise Basin	5	6	339	323	35	358	5,549	10	5,559	400	10,000		17,285
Summit Flat	2		55	47		47	24		24				1,662
Bonner County:													
Lakeview	2		500	10		10	3,510		3,510	800	12,000	18,000	5,794
Pend d'Oreille	2		11,166				14,019		14,019		585,000		53,844
Bonneville County: Mount Pisgah		1			17	17							595
Boundary County:													
Moyie Yahk	1		6,300	616		616	7,401		7,401	7,000	198,000	201,000	64,291
Port Hill	1		10,560	6		6	12,060		12,060	6,600	632,000	23,000	59,528
Butte County:													
Dome	1		151				270		270		40,000		3,192
Lava Creek	1		4,117	75		75	21,593		21,593	4,300	357,000	348,000	82,898
Camas County:													
Beaver	1		479	154		154	1,731		1,731	2,400	9,000		7,608
Gold Belt	1		3	10		10	7		7				355
Little Smoky and Carrietown	2		45	2		2	1,104		1,104	100	1,000		943
Skeleton Creek	1		5	32		32	17		17				1,132
Cassia County: Stokes	1		3				14		14		2,000		160
Clark County: Birch Creek	1		54				76		76		19,000		1,479
Clearwater County:													
Moose Creek and Independence Creek		1			2	2							70
Pierce		4			10	10							350
Custer County:													
Alder Creek	5		467	16		16	1,485		1,485	9,900	99,000	14,000	11,840
Bayhorse	5		35,895	81		81	211,119		211,119	51,300	2,962,000	991,000	488,811
Yankee Fork	2	1	18	153	33	186	208	28	236	100			6,691

Elmore County:													
Bear Creek	1		12	54		54	83		83				1,949
Middle Boise	2	1	53,479	13,867	1	13,868	45,246		45,246				517,555
Volcano	1		60	1		1	242		242	100	4,000		520
Gem County: West View	1		183	60		60	1,956		1,956		23,000	19,000	7,268
Idaho County:													
Burgdorf-Marshall Lake		1			4	4							140
Camp Howard (Salmon River)		1			8	8							280
Dixie		1			3	3							105
Elk City		(1)			10	10							350
Florence and French Creek	1		2	4		4	7		7				145
Newsome		1			4	4							140
Ramey Ridge	1		1,170	187		187	24		24				6,562
Robbins	(1)		1	6		6	14		14				220
Simpson (Salmon River)	1		16	5		5							175
Ten Mile	1		80	9		9	7		7				320
Warren		(1)			75	75		24	24				2,642
Latah County:													
Gold Creek		1			1	1							35
Moscow Mountain		1			2	2							70
Lemhi County:													
Blue Wing	1		27,857	15		15	48,216		48,216	60,000	91,000		49,437
Gibbonsville (Dahlonega)		1			3	3							105
Junction	2		15				388		388		13,000		1,251
Mackinaw	1		54	1		1	17		17	12,400			1,659
North Fork	1		1				156		156	100			124
Spring Mountain	1		50				45		45	2,300	2,000		481
Texas	2		438	19		19	3,593		3,593	1,400	112,000		11,802
Unorganized (Reno)	1		139	1		1	616		616		44,000		3,773
Nez Perce County: Snake River		2			23	23		7	7				810
Owyhee County:													
Carson or French	1	1	5	55	1	56	793		793				2,524
Snake River		1			1	1							35
South Mountain	1		4,706	55		55	42,407		42,407	63,800	78,000	1,266,000	182,953
Shoshone County:													
Beaver	4	1	86,982	94	3	97	108,405		108,405	83,300	4,515,000	8,071,000	1,301,605
Eagle	1	1	461	1	3	4	1,274		1,274	900	95,000	28,000	11,312
Evolution	4		397,431	150		150	5,745,721		5,745,721	2,838,200	7,543,000	4,000,000	5,457,787
Hunter	8		539,705	344		344	928,378		928,378	287,600	41,410,000	59,765,000	10,269,978
Lelande	8		312,999	339		339	967,569		967,569	207,300	36,168,000	19,299,000	5,523,755
Placer Center	4		160,425	265		265	313,716		313,716	120,000	14,300,000	17,548,000	3,215,646
Summit	1	1	136	11	6	17	308		308		16,000		2,014
Yreka	17		772,246	1,034		1,034	2,237,469		2,237,469	436,700	75,579,000	50,557,000	12,812,631
Valley County:													
Deadwood Basin	1		18,934	250		250	66,579		66,579	56,000	632,000	1,663,000	290,379
Thunder Mountain		1			2	2							70
Yellow Pine	1		178,747	5,480		5,480	173,354		173,354				315,074
Washington County: Washington	2		107				2,032		2,032	4,000	1,000		2,040
Total Idaho	127	30	2,741,747	30,553	255	30,808	11,700,111	69	11,700,180	4,648,000	192,914,000	173,414,000	43,199,910

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[1] Production represents clean-up at idle property.

Comment on districts with small production has been omitted owing to lack of space.

ADAMS COUNTY

A total of 88 tons of copper ore was produced in 1943 from two properties near Cuprum in the Seven Devils district; 52 tons came from the South Peacock mine and 36 tons from the Helena claim.

BLAINE COUNTY

Lava Creek district.—Hoyt Ray operated the Paymaster mine, 32 miles southwest of Arco, a few months in 1943 and shipped 1,069 tons of zinc-lead ore to custom concentration mills in Utah.

Little Wood River (Muldoon) district.—One car (30 tons) of silver-lead ore from the Eagle Bird mine in Garfield Canyon was shipped direct to a smelter in 1943, and 24 tons of zinc-lead ore from the Idaho Muldoon mine were treated in a custom concentration mill in Utah.

Mineral Hill and Camas district.—As in 1942, the principal output in the Mineral Hill and Camas district in 1943 was siliceous gold ore from the Camas mine, 10 miles west of Hailey. The Camas Trust Co. operated the mine throughout the year and shipped 3,200 tons of gold ore direct to a smelter. The remainder of the district output was largely silver-lead old tailings (758 tons) from the Minnie Moore property, gold ore (140 tons) from the Treasure Vault mine, and rich lead-silver ore (32 tons) from the Lark claim.

Warm Springs district.—Except for mines in the Coeur d'Alene region, the output of zinc-lead-silver ore from the Triumph-North Star-Independence groups near Ketchum continued to be the greatest from any property in Idaho, although it was less than in 1942. The Triumph Mining Co. operated the groups throughout the year and treated 33,505 tons of low-grade marginal zinc-lead-silver ore in its 300-ton concentration mill, yielding lead concentrates and zinc-lead middlings. The middlings (9,431 tons) and 74,889 tons of higher-grade zinc-lead-silver ore were shipped to custom flotation mills at Bauer and Tooele, Utah. The rest of the district output was mainly 778 tons of old tailings (silver-lead) from the Independence dump, 271 tons of zinc-lead ore from the Blue Kitten and Homestake properties, 161 tons of zinc ore from the Lucky Boy and Horseshoe properties, and 112 tons of gold ore from the June Day mine.

BOISE COUNTY

Boise Basin district (Centerville, Placerville, Idaho City, Pioneerville, Quartzburg).—During the past decade placer gold (recovered principally by bucket dredges) has been the main source of metal production in the Boise Basin district. The output of gold from placers dropped from 13,112 ounces in 1942 to 35 ounces in 1943, as all types of dredging ceased in October 1942 owing to the gold-mine closing order of the War Production Board. Nearly all the district output in 1943 was gold ore (276 tons) from the Hay Fork, Julian, and Summit properties treated by amalgamation, and zinc-lead ore (57 tons) averaging 2.81 ounces of gold and 95.39 ounces of silver to the ton, 0.48 percent copper, 8.02 percent lead, and 6.65 percent zinc, from the Come-Back mine at Pioneerville shipped direct to a smelter.

Summit Flat district.—The Golden Cycle and Viking properties north of Idaho City were operated in 1943, and a total of 54 tons of gold ore was treated by amalgamation.

BONNER COUNTY

Lakeview district.—The output of the Lakeview district in 1943 was 300 tons of silver ore, containing appreciable quantities of lead and zinc, from the Hewer (Idaho Lakeview) mine and 200 tons of zinc-lead ore from an old waste dump at the Keep Cool property, all treated by flotation.

Pend d'Oreille district.—Silver-lead ore from the Hope (Elsie K.) mine near Clark Fork continued to be the principal output in the Pend d'Oreille district. Hope Silver-Lead Mines, Inc., operated the mine and its 150-ton flotation mill throughout 1943 and treated 11,094 tons of ore containing 15,000 ounces of silver, 600,000 pounds of lead, and 245,000 pounds of zinc. Silver-lead concentrates (402 tons) and crude silver-lead ore (26 tons) were shipped to the smelter at East Helena, Mont.; no zinc concentrates were produced.

BOUNDARY COUNTY

Moyie Yahk district.—During the first 6 months of 1943 Silver Crescent, Inc., built a 50-ton flotation plant at its Regal property 14 miles northeast of Bonners Ferry. The plant operated continuously from July 1 to December 31 and treated 6,300 tons of ore containing 690 ounces of gold, 9,400 ounces of silver, 10,080 pounds of copper, 300,000 pounds of lead, and 300,000 pounds of zinc; lead concentrates and zinc concentrates were shipped to smelters at Bradley, Idaho.

Port Hill district.—Trueman Higginbotham after operating the Idaho-Continental mine under lease throughout 1942 turned his lease over to A. B. Cobb January 1, 1943. Cobb operated the mine and 90-ton flotation mill continuously until September 30, 1943, and treated 10,560 tons of silver-lead ore.

BUTTE COUNTY

Dome district.—A lessee operated the Great Western mine near Howe in 1943 and shipped 151 tons of lead ore to a smelter in Utah.

Lava Creek district.—The Horn Silver mine on Champagne Creek 20 miles southwest of Arco was operated continuously the last 6 months of 1943 by the Era Mining & Development Co.; a total of 4,117 tons of ore, averaging 0.02 ounce of gold and 5.84 ounces of silver to the ton, 0.07 percent copper, 4.89 percent lead, and 5.93 percent zinc, was shipped to custom concentration mills at Bauer and Midvale, Utah.

CAMAS COUNTY

Beaver Creek district.—Various lessees worked at the Princess-Blue Ribbon mine near Fairfield in 1943 and shipped 479 tons of siliceous gold ore to the smelter at Garfield, Utah. In addition to the gold, silver, copper, and lead content, the ore averaged more than 80 percent in silica and was greatly desired by the smelting company for use as a flux.

Little Smoky and Carrietown district.—Virtually all the output of the Little Smoky and Carrietown district in 1943 was silver ore (43 tons) shipped from the waste dump of the Stormy Galore property near Fairfield.

Skeleton Creek district.—A small lot (5 tons) of high-grade gold ore was produced in 1943 from the Red Horse mine near Fairfield.

CLARK COUNTY

The only output in Clark County in 1943 was 54 tons of lead ore produced from the Scott mine on Birch Creek. A $10,000 loan granted by the Reconstruction Finance Corporation to the Birch Creek Mining Co., Ltd., enabled the company to develop the mine throughout the year.

CUSTER COUNTY

Alder Creek district.—The Champion mine 5 miles south of Mackay was operated during the last 6 months of 1943, and 322 tons of lead ore were shipped to a smelter. The rest of the district output was mainly zinc-lead ore (78 tons) from the Horseshoe mine and copper ore (49 tons) from the Empire mine. The Federal Bureau of Mines did considerable drilling during the year at the Empire mine, and the Federal Geological Survey did some exploration.

Bayhorse district.—The Clayton mine, operated by Clayton Silver Mines, continued to be a large producer of zinc-lead ore; in 1943 about 34,500 tons of ore, containing 195,360 ounces of silver, 3,028,980 pounds of lead, 1,622,000 pounds of zinc, and a little gold and copper, were treated in the company 120-ton flotation mill. The output of ore and the production of lead and zinc were less than in 1942, but the silver output was greater. According to the company printed annual report, the labor situation at the property was fairly satisfactory until the end of May; but from that time on it was difficult to operate, and any development was out of the question if production was to be maintained. With the small number of men available and doing no development, production was still insufficient to keep the mill running at capacity; consequently, it was idle 627 hours during the year. In spite of the subnormal amount of development, the ore reserves were substantially increased during the year. The estimate now places the reserves at 80,000 tons and, in addition, 60,000 tons of probable ore to the north and below the new ore body on the 300 level.

The remainder of the district output was largely lead-silver ore (633 tons) from Salmon River Mines, lead ore (531 tons) from the South Butte mine, and copper-lead-silver ore (135 tons) from the Ramshorn mine. Some of the ore from the Ramshorn mine averaged 166 ounces of silver to the ton, 6 percent copper, and 9 percent lead.

Yankee Fork district.—Gold output in the Yankee Fork district decreased from 5,677 ounces in 1942 to 186 ounces in 1943 and silver from 16,027 to 236 ounces. These large decreases resulted from the closing in 1942 of the 8-cubic foot bucket dredge of the Snake River Mining Co. and the General Custer-Lucky Boy lode mine. The closing was due chiefly to Government regulations. Nearly all the output of the district in 1943 was high-grade gold ore (17 tons) from the Fourth of July claim and placer gold and silver from the Horse Trail property.

ELMORE COUNTY

Bear Creek district.—Lessees operated the Vishnu mine at Rocky Bar in 1943 and shipped 11 tons of ore averaging 4.5 ounces of gold and 7.5 ounces of silver to the ton.

Middle Boise (*Atlanta*) *district.*—The Middle Boise district continued in 1943 to be the largest gold-producing area in Idaho, owing to mining and milling of gold ore from the Boise-Rochester-Monarch groups by Talache Mines, Inc. The company treated 53,424 tons of gold ore in its 400-ton amalgamation and concentration mill compared with 87,747 tons in 1942 and shipped 54 tons of rich gold ore direct to a smelter. In addition to gold and silver, the milling ore contains arsenic and tungsten; in 1943, as in 1942, some tungsten concentrates were produced and marketed. The output of placer gold in the district decreased from 6,385 ounces in 1942 to 1 ounce in 1943, owing principally to the closing in October 1942 of the 7½-cubic foot bucket dredge of Boise King Placers.

GEM COUNTY

West View district.—The Friday Mining Co. operated the Friday mine at Pearl throughout 1943 and shipped 183 tons of zinc-lead ore to a custom flotation mill in Utah. The Lincoln mine, a large producer of gold ore in 1942, was idle in 1943.

IDAHO COUNTY

Elk City district.—Gold output in the Elk City district decreased from 5,901 ounces in 1942 to 10 ounces in 1943, owing chiefly to the closing of four dredges in 1942.

Ramey Ridge district.—In 1943 about 1,170 tons of gold ore from the Snowshoe mine near Big Creek were treated by amalgamation and concentration. The mine and 25-ton mill were operated the first 6 months of the year by a small crew of stockholders of Snowshoe Gold, Inc.

Ten Mile district (*Golden*).—The only output in the Ten Mile district in 1943 was 80 tons of gold ore from the Shamrock mine treated by amalgamation and concentration. However, the operating company (White Mines, Inc.) discovered tungsten in all 11 tunnels of the mine.

Warren district.—The 2½-cubic foot bucket-line dredge, operated in 1942 on Warren Meadows by W. W. Prather, was idle in 1943; 114 ounces of gold bullion were cleaned up from the dredge and sold in 1943.

LATAH COUNTY

Hoodoo district.—The Hoodoo district had an output of 6,012 ounces of gold and 329 ounces of silver in 1942 but no metal output in 1943, owing principally to the closing in October 1942, by Government order, of the 4½-cubic foot bucket dredge of Northwest Goldfields.

LEMHI COUNTY

Blue Wing district.—The Ima mine at Patterson was operated continuously in 1943 by the Ima Mines Corporation; 27,857 tons of ore, containing 52,000 ounces of silver, 100,000 pounds of copper, 139,000 pounds of lead, 557,000 pounds of iron, and some tungsten, were treated in the company 150-ton gravity and flotation mill equipped with a magnetic separator. Lead-copper-silver concentrates (946 tons) were shipped to a smelter in Utah, and tungsten concentrates were sent to an eastern market.

Gibbonsville (Dahlonega) district.—Gold output in the Gibbonsville district decreased from 4,440 ounces in 1942 to 3 ounces in 1943, chiefly because of the closing of two dredges in 1942.

Junction district.—A total of 15 tons of crude lead-silver ore was produced in 1943 from the Bullion Apex and Plymouth properties near Leadore.

Mackinaw district.—A lessee worked the Copper King mine, 8 miles south of Shoup, throughout 1943 and shipped 54 tons of crude copper ore to a smelter.

Mineral Hill district.—The Mineral Hill district had no metal output in 1943, as Gold Producers, Inc., a large producer of gold ore in 1942, was idle.

Texas district.—In 1943 about 300 tons of lead-silver ore from Latest Out mine and 145 tons of similar ore from the Hill Top mine were shipped direct to a smelter.

Unorganized (Reno) district.—Development in 1943 at the Cabin mine near Reno resulted in the shipment of 3 cars (139 tons) of crude lead-silver ore.

NEZ PERCE COUNTY

Snake River district.—Placer operators sluiced gravel bars along Snake River below Lewiston in 1943 and recovered 23 ounces of gold and 7 ounces of silver.

OWYHEE COUNTY

Carson district (Silver City, De Lamar).—The output of the Carson district in 1943 comprised 4 tons of mill cleanings, containing 50 ounces of gold and 370 ounces of silver, recovered from the De Lamar Milling Corporation mill when it was dismantled, 122 pounds of rich gold-silver ore from the South Central mine, and 1 ounce of placer gold recovered from the Long Gulch claim.

South Mountain district.—About 4,700 tons of ore, containing sphalerite, galena, and chalcopyrite, were shipped in 1943 from the Golconda mine to the International flotation mill at Tooele, Utah. The mine was operated under lease throughout the year by the South Mountain Mining Co., but the output of gold, silver, copper, lead, and zinc was much less than in 1942.

SHOSHONE COUNTY

COEUR D'ALENE REGION

In 1943 the Coeur d'Alene region of Shoshone County remained the largest silver-producing area in the United States and again ranked second in lead and third in zinc; it produced 88 percent of Idaho's silver, more than 85 percent of the copper, 93 percent of the lead, and 92 percent of the zinc. The value of the metal output of the region was $38,594,728 compared with $38,880,253 in 1942. The output of each metal except zinc decreased; gold declined 16 percent, silver 21, copper 34, and lead 16 percent. The output of zinc in 1943 exceeded the record of 1942 by nearly 2 percent. The chief producers of zinc in the region in 1943, according to rank (each producing more than

12,700,000 pounds), were the Star, Morning, Bunker Hill & Sullivan (mine), Tamarack, Bunker Hill & Sullivan zinc slag-fuming plant, and Page properties; the chief producers of lead, according to rank (each producing more than 9,000,000 pounds), were the Bunker Hill & Sullivan, Morning, Hecla, Page, Star, Tamarack, and Sherman properties; and the chief producers of silver, according to rank (each producing more than 400,000 ounces), were the Sunshine, Bunker Hill & Sullivan, Mineral Point, Hecla, Page, Morning, and Polaris properties.

Of the total material (2,270,385 tons) produced in the Coeur d'Alene region in 1943, more than 77 percent was zinc-lead ore and old tailings, 11 percent silver ore, 9 percent lead-silver ore, and the remainder nearly all zinc slag. Most mines in the region worked 6 days a week and milling plants 7 days a week. Miners' wages remained at $8.25 a shift throughout the year. The outstanding features of the year were the discovery in June of high-grade lead-silver ore in the Chester vein of the Sunshine property; the completion in April of the Bunker Hill & Sullivan zinc slag-fuming plant at Bradley and the Hecla 2,000-ton zinc-lead tailing plant at Osburn; and the marked decrease in output of silver, lead, and zinc from the Hecla mine at Burke, resulting from gradual depletion of zinc-lead-silver ore reserves.

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1942–43, and total, 1884–1943, in terms of recovered metals

Year	Mines producing		Ore.	Gold (lode and placer)	Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer							
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1942	49	7	2,327,417	2,688	12,977,287	5,986,000	212,947,000	156,625,000	$38,880,253
1943	47	3	2,270,385	2,250	10,302,840	3,974,000	179,626,000	159,268,000	38,594,728
Total, 1884–1943	------	-------	(1)	387,335	410,846,735	[2] 62,247	[2] 5,335,276	[2] 966,180	1,016,686,304

[1] Figures not available.
[2] Short tons.

Beaver district.—The output of the Beaver district in 1943 was 86,922 tons of zinc-lead ore and 60 tons of lead ore compared with 83,513 tons of zinc-lead ore in 1942. About 36,900 tons of zinc-lead ore from the Amazon-Manhattan-Portland groups (Monitor Mining Co.) were treated in the Hercules and Dayrock custom flotation mills near Wallace; 15,700 tons of zinc-lead ore from the Interstate-Callahan mine and 9,400 tons of similar ore from the mine waste dump were treated in the flotation mill of Zanetti Bros. near Wallace; and 24,917 tons of zinc-lead ore from the Sunset mine were treated in the Golconda custom flotation mill, also near Wallace. A total of 3,311 tons of lead-silver concentrates was shipped to lead smelters at East Helena (Mont.) and Kellogg, and a total of 8,894 tons of zinc concentrates was shipped to electrolytic zinc plants at Anaconda (Mont.) and Kellogg. The content of all ores treated averaged 1.51 ounces of silver to the ton, 0.08 percent copper, 3.20 percent lead, and 6.35 percent zinc.

Eagle district.—Lessees worked at the Crystal Lead property near Murray in 1943 and hauled 456 tons of zinc-lead ore to the Hercules mill and sold 5 tons of high-grade crude lead-silver ore to the Bunker Hill smelter.

Evolution district.—A total of 270,113 tons of ore and 127,318 tons of old tailings was treated in 1943 in the Evolution district, compared with 417,898 tons of ore and old tailings in 1942. The output comprised 141,955 tons of silver-copper-antimony ore from the Sunshine mine; 21,405 tons of high-grade lead-silver ore from the Chester vein of the Sunshine property; 78,753 tons of silver ore from the Mineral Point mine; 28,000 tons of silver ore from the Polaris mine; and 127,318 tons of old zinc-lead tailings from the Osburn dump, operated by the Hecla Mining Co. According to the printed annual report of the Sunshine Mining Co. the most important development during the year was the discovery, on the 2,700 level of the Sunshine property, of high-grade lead-silver ore in the Chester vein and fault zone. This structurally complex zone is north and east of the Sunshine vein system and had been prospected in the past by both the Sunshine and Polaris Mining Cos. on higher levels with negative results. The new discovery was made in the course of exploration undertaken at the request of the Polaris Mining Co., and subsequent work has disclosed excellent ore at various points for 600 feet on the strike and 750 feet on the dip, with the full extent of the ore zone in both strike and dip still to be determined. To avoid the complexity and particularly the delay of legal determination of rights to the ore under existing mining law, certain compromise agreements were entered into. A dividing plane was established, and two areas were created on the Chester vein. In the Rambo area west of the dividing plane, the equities in the ore are Sunshine 60 percent and Silver Syndicate, Inc., 40 percent. In the Omega area east of the dividing plane, the Sunshine and Polaris Mining Cos. have equal rights. All mining and milling of ore from the two areas will be done by the Sunshine Mining Co. The total ore mined by the company from all sources in 1943 was 163,360 tons (including 9,800 tons of lead-silver ore mined for Polaris account). This represents a decrease of 88,340 tons from 1942, due entirely to an acute labor shortage throughout the year. The silver-copper-antimony ore (141,955 tons), containing an average of 23.46 ounces of silver to the ton, 0.40 percent copper, and a little lead and antimony, was concentrated into two products—one a high-grade silver-copper-antimony concentrate, which was treated in the company leaching and electrolytic antimony plant for the recovery of antimony, and the other a low-grade silver-iron concentrate, which was shipped direct to a smelter. The residue remaining after the antimony had been leached was shipped to a copper smelter to recover the silver and copper contents. As of May 1, 1943, the Sunshine Mining Co. made a contract with the Coeur d'Alene Mines Corporation to purchase all silver-copper-antimony concentrates produced at the 600-ton flotation mill of the Coeur d'Alene Mines Corporation; since that time these concentrates have been treated along with Sunshine concentrates for recovery of the antimony. The total output of silver from the Sunshine mine in 1943 was 3,828,370 ounces compared with 4,976,859 ounces in 1942.

According to the printed annual report of the Coeur d'Alene Mines Corporation, 78,753 tons of ore were mined and treated in 1943, containing an average of 10.86 ounces of silver to the ton, 1.0 percent copper, and 0.56 percent antimony. The concentrates (2,507 tons) contained 839,610 ounces of silver, 1,551,228 pounds of copper, and 880,833 pounds of antimony—a marked decrease from the metal output in 1942. A total of 2,152 feet of drifting, raising, and crosscutting was done during the year, and the shaft was sunk from the 2,097 to the 2,282 level; the chief production is now coming from the 1,600 and 2,000 levels. The property remained the largest producer of copper in Idaho and ranked third in silver and antimony. Mining and milling of silver ore from the Polaris mine were continuous until August 30, 1943, when milling of Polaris ore ceased. Beginning September 1, the 200-ton flotation mill was used to treat zinc-lead middling produced at the Osburn tailing plant. According to the printed annual report of the Polaris Mining Co., mining of ore on the Polaris vein is being continued with the limited number of men available, but only approximately 15,000 tons of ore remained to be treated as of December 1, 1943. Some development has been carried on, but no additional ore of importance was found on the Polaris vein. About 28,000 tons of silver ore were mined and treated from this vein in 1943.

The Hecla Mining Co. completed building in April a 2,000-ton plant to treat old zinc-lead tailings at Osburn. During the remainder of the year the plant merely screened and cleaned the old tailings, as a shortage of supplies and labor delayed completion of the sink-and-float unit of the plant. The company reported that about 126,000 tons of old tailings were treated in 1943, containing an average of 1.50 ounces of silver to the ton, 1.86 percent lead, 1.93 percent zinc, and a little copper; the resulting zinc-lead middling was shipped to the Hecla and Polaris flotation mills, where it was separated into lead concentrates and zinc concentrates. A flotation unit was added to the plant late in the year, which, along with the sink-and-float unit, will be in operation early in 1944.

Hunter district (*Mullan*).—The output of recoverable zinc in the Hunter district in 1943 was 59,765,000 pounds, the greatest in any district of Idaho but a decrease of 12 percent from that in 1942; the Star mine of the Sullivan Mining Co. at Burke continued to be the chief producer. The 1,000-ton flotation mill at the mine operated throughout the year and treated 238,509 tons of ore (242,900 tons in 1942), yielding 10,266 tons of lead concentrates and 37,460 tons of zinc concentrates, which contained 240,607 ounces of silver, 16,812,000 pounds of lead, and 38,705,000 pounds of zinc. The company reported that the mill operated 7 days a week for the first 3 months of the year, when a shortage of labor in the mine compelled a reduction to 6 days a week. Mining and milling at the Morning property of the Federal Mining & Smelting Co. at Mullan were continuous in 1943. The 1,250-ton flotation mill treated 178,122 tons of mine ore containing an average of 2.3 ounces of silver to the ton, 6.5 percent lead, and 8.2 percent zinc, and 56,545 tons of waste-dump ore containing an average of 1.1 ounces of silver to the ton, 1.4 percent lead, and 1.0 percent zinc; the lead concentrates and zinc concentrates produced from both mine ore and waste-dump ore contained 192 ounces of gold, 435,614 ounces of silver, 23,160,203 pounds of lead, and 29,311,860 pounds of zinc. The metal output was much less than in 1942, owing to the treatment of waste-dump ore. According to the printed annual report of the company, the labor shortage continued during the year, and employment reached a low point during the summer months. In September some relief resulted from the furloughing of soldiers by the Army for mine work; 121 of these men were sent to the Morning mine. However, at the end of 1943 the crew was practically the same as on January 1, which is about 75 men below normal.

As the Morning mill capacity was considerably greater than was required for the treatment of mine ore, a substantial tonnage of low-grade ore from Morning dumps was treated in the mill during the last 7 months of the year. This operation proved profitable under premium metal prices.

The offset shaft was sunk an additional depth of 205 feet during the year and reached a total depth of 1,116 feet below the 3,850 level. Owing to the shortage of labor, the work of cutting the station and ore pockets and driving the crosscut to the vein on the 4,850 level has not begun. On the 4,650 level the drift westward on the vein was driven 714 feet to the west end of the Morning claim. The ore shoot on this level is 680 feet long. Ore reserves at the end of the year, including developed and probable ore in both the Morning and You Like portions of the mine, are estimated at 620,000 tons, a decrease of 60,000 tons from the estimated tonnage at the end of 1942. Lessees continued to operate the Gold Hunter mine and 500-ton flotation mill at Mullan; 52,760 tons of ore averaging 3.62 ounces of silver to the ton, 2.46 percent lead, and 0.45 percent zinc were treated in 1943 compared with 65,417 tons in 1942. The rest of the district output was largely zinc-lead-silver ore (7,072 tons) from the Lucky Friday mine, zinc-lead ore (4,571 tons) from the Golconda mine, and old waste-dump zinc-lead ore (2,000 tons) from the Simia claim. All the ore from the Lucky Friday and Golconda mines was treated in the Golconda custom flotation mill near Wallace.

Lelande district (Burke, Mace, Frisco).—The output of the Lelande district in 1943 comprised 256,732 tons of zinc-lead-silver ore and old tailings, 56,217 tons of lead ore, and 50 tons of mill cleanings. The Hecla mine at Burke continued to be the most important producer, although its output of zinc-lead-silver ore decreased from 274,938 tons in 1942 to 140,400 tons in 1943. Lead concentrates (15,026 tons) and zinc concentrates (8,106 tons) produced in the 900-ton flotation mill at the mine contained 163 ounces of gold, 544,435 ounces of silver, 132,500 pounds of copper, 22,503,600 pounds of lead, and 10,625,000 pounds of zinc, a considerable decrease from the output in 1942. According to the printed annual report of the company, operations at the Hecla mine were continuous throughout the year and will proceed upon a small output basis during the first 6 months in 1944. No new ore of importance was found in 1943, and only lack of manpower prevented complete removal of ore reserves during the year. The lack of an adequate working force and the general inefficiency of what replacements could be obtained hampered all operations and delayed all construction work. The mill, however, is operating at full capacity 7 days a week on mine ore and Osborn tailing-plant material.

The lower levels of the Frisco mine were operated throughout the year by the Federal Mining & Smelting Co. (owners of the property) and the upper levels by the Hull Lease; 31,530 tons of ore, containing an average of 1.38 ounces of silver to the ton, 4.10 percent lead, and 5.80 percent zinc, were produced on company account and treated in the Morning flotation mill, and 28,081 tons of similar ore were produced by the Hull Lease and treated in its own 90-ton flotation mill. According to the printed annual report of the Federal Mining &

Smelting Co., mining operations at the Frisco mine were continuous in 1943 upon a basis of 6 days a week. During the year the water level was lowered to a point below the 1,200 level, and the station on this level was rehabilitated; a new 350-ton ore bin was built, and the entire surface plant (consisting of mine dry house, warehouse, office, and other buildings) was enlarged and improved; a total of 1,120 feet of development was done on the 800, 1,000, and 1,200 levels. Ore reserves at the end of the year were estimated at 217,500 tons of developed and probable ore. From present indications, additional ore will be developed as the lower levels are made accessible. Mining and milling at the Sherman property were carried on throughout the year by the Sherman Lead Co. The company reported that 56,217 tons of ore were treated in its 300-ton flotation mill and contained 322,427 ounces of silver, 10,198,580 pounds of lead, and 2,340,000 pounds of zinc. According to the printed annual report of the company, no zinc concentrates were produced in 1943, but a greater economic return for zinc was secured through the content of this metal in the lead concentrates than could have been obtained in a separate mill zinc concentrate.

The Sherman mine and mill are in excellent condition, and output of ore could be quickly increased if workers were available. This lack of manpower is the most critical factor affecting company operation, and unless the present situation changes for the better the management anticipates that production in 1944 will show considerable reduction.

The Formosa mill on Canyon Creek 3½ miles northeast of Wallace was rehabilitated and equipped by the Small Leasing Co. late in 1942 with three units of flotation machines to treat old zinc-lead tailings deposited along Canyon Creek above Wallace. The mill operated continuously in 1943 and treated 46,000 tons of old tailings, containing an average of 2 ounces of silver to the ton, 2 percent lead, and 4.5 percent zinc. In addition, 8,535 tons of similar material were hauled to the Golconda custom mill for treatment. The remainder of the district output was mainly old zinc-lead tailings (1,000 tons) from the Vermillion Homestead and zinc-lead ore (880 tons) from the Poorman waste dump.

Placer Center district.—About 132,700 tons of zinc-lead-silver ore and 27,700 tons of lead-silver ore were produced in 1943 in the Placer Center district; the principal producer was the Tamarack mine operated throughout the year by the Tamarack & Custer Consolidated Mining Co. According to the printed annual report of the company the Tamarack mine was operated upon a basis of 6 days a week and the 400-ton flotation mill upon a basis of 7 days a week; 114,073 tons of ore were produced and treated, containing 180,317 ounces of silver, 10,746,110 pounds of lead, and 19,487,046 pounds of zinc. In addition, lessees shipped 64 tons of high-grade lead-silver ore direct to a smelter and hauled 4,730 tons of zinc-lead-silver ore to custom flotation mills. An average crew of more than 200 men is required at the Tamarack mine to maintain normal production and development. At no time during 1943 were so many workers available, and the present shortage is about 25 percent. In September 1943 the War Department recognized the seriousness of the situation and furloughed several hundred soldiers to the district; the Tamarack allotment was 72. The mine and mill are in good physical condition and are prepared for maximum production in 1944. A shortage of labor is again anticipated, however, and this present and potential lack of manpower is the most critical factor affecting the company output. Unless totally unforeseen conditions develop, the management believes that the operations in 1944 will continue at about the same rate as in the past year.

The Dayrock Mining Co. operated its mine and 200-ton flotation mill continuously in 1943; 27,556 tons of silver-lead ore were produced and treated. According to the company printed annual report the ore contained 148,399 ounces of silver, 3,681,378 pounds of lead, and 521,200 pounds of zinc; however, the mill produced only one product—a silver-lead concentrate; thus, no zinc was recovered. Exploration during the year was confined principally to the 400 and 500 levels, the lowest in the Dayrock mine. Following successful diamond drilling on these levels, a new vein, designated as the "South," was developed by crosscutting and drifting during the latter part of 1943. Although the ore discovered in this vein is not continuous and averages lower in grade than the mill feed produced heretofore, the "South" vein promises to yield a substantial tonnage of ore in the future.

The Callahan Consolidated Mines Co., operating the Red Monarch, Rex, and Delaware groups near Wallace, completed building a 100-ton flotation mill in February 1943. During the remainder of the year the mill treated about 11,900 tons of zinc-lead ore; lead concentrates (327 tons) were shipped to the Bunker Hill lead smelter and zinc concentrates (545 tons) to the Sullivan zinc plant. The rest of the district output was 2,107 tons of zinc-lead ore from the Success mine, operated by lessees.

Yreka district (Kellogg).—A total of 772,246 tons of ore, old tailings, and slag was treated in 1943 from properties in the Yreka district—the largest output in any district of Idaho and an increase of 8 percent over 1942; most (87 percent) of it was zinc-lead ore and old tailings. The Bunker Hill & Sullivan mine at Kellogg, with an output of 360,908 tons of zinc-lead-silver ore, was the principal producer, although its output was 12 percent less than in 1942. In addition, the company treated 42,480 tons of old jig tailings (containing silver, lead, zinc, and iron) in a 300-ton gravity-flotation plant especially built to treat this material. The mill produced two products—a high-grade iron concentrate and a low-grade lead-iron concentrate. The company main 1,700-ton gravity-flotation mill, equipped with a sink-and-float unit, treated 360,908 tons of ore from the Bunker Hill & Sullivan mine (containing an average of 4.31 ounces of silver to the ton, 6.73 percent lead, 3.59 percent zinc, and a little copper) and 38,383 tons of old tailings from the Sweeny dump (containing 0.74 ounce of silver to the ton, 1.74 percent lead, and 1.06 percent zinc); E. G. Smith operated a portion of the Sweeny tailing dump during 1943 and treated about 28,000 tons of similar material in the Crescent flotation mill, which he is leasing. The Bunker Hill & Sullivan mine remained the largest producer of lead in Idaho and ranked second in silver and third in zinc. According to the company printed annual report there were produced and recovered from Bunker Hill mine ore (including 12,250 tons of lessee ore) 1,409,566 ounces of silver, 46,650,000 pounds of lead, and 22,440,000 pounds of zinc. The bottom level of the mine, 2,800 feet vertically below the Kellogg adit tunnel and 400 feet below sea level, is the practical working limit of the present company hoisting equipment, which has given excellent service for nearly 20 years. Because of this, a new hoist has been purchased and is now being installed; it should be in operation before the end of 1944. This new hoist will give, as a minimum, an additional working depth of 1,200 vertical feet. Underground development was confined to the addition of ore bodies in currently mined areas, particularly the Truman vein on 21 and 23 levels. Ore reserves January 1, 1944, undercut and available for mining, totaled 2,874,771 tons of zinc-lead-silver ore. Operations at the zinc slag-fuming plant of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley began in April. During the remainder of the year the plant treated 55,976 tons of hot current slag and 23,482 tons of old reclaimed dump slag, but only the old dump slag and 15,983 tons of the hot slag were credited directly to the fuming-plant operation. Zinc recovered from this new source substantially increased in 1943 the total output of zinc in the Yreka district.

Mining and milling of zinc-lead-silver ore from the Blackhawk and Page mines by the Federal Mining & Smelting Co. were continuous throughout the year. The company reported that 141,460 tons of ore from the Page mine and 12,621 tons of ore from the Blackhawk mine, containing 619,405 ounces of silver, 24,159,800 pounds of lead, and 18,520,000 pounds of zinc, were treated in the Page 500-ton flotation mill. According to the printed annual report of the company the labor shortage experienced by most of the companies in the Coeur d'Alene region caused a loss of about 10 percent of the Page crew during the summer months; however, the crew is now (Jan. 1, 1944) normal. The drift east and west on the Tony vein in the Page mine on the 2,400 level was driven 425 feet in 1943. The ore shoot found on this level is 1,890 feet long and of good average width and excellent grade. Ore reserves at the end of the year were estimated at 655,000 tons of developed and probable ore, a decrease of 20,000 tons from the estimated tonnage at the end of 1942. About 21,500 tons of zinc-lead ore from the Spokane-Idaho property (Constitution) were treated in 1943 in the company 100-ton flotation mill, which produced zinc-lead concentrates. The company made preparations to sink the three-compartment shaft to the 1,000 level. Mining and milling operations were carried on continuously at the Little Pittsburg mine by the Denver Development Co. until July 14, 1943, when a dynamite explosion caused a fire that completely destroyed the surface buildings and suspended operations until August 25. Reconstruction and equipment of the buildings were virtually completed by the end of the year. A total of 20,069 tons of zinc-lead ore was treated during the year in the company 100-ton flotation mill and the Amy-Matchless mill. The Highland-Surprise Consolidated Mining Co. operated its mine and mill from April 1 to the end of the year; the 150-ton flotation mill treated 18,130 tons of zinc-lead ore yielding 3,576 tons of zinc-lead concentrates. The Small Leasing Co. completed building in August a new 100-ton flotation mill at the Douglas mine on Pine Creek; during the remainder of the year the mill treated 12,789 tons of zinc-lead ore yielding 1,727 tons of zinc-lead concentrates. The output from the rest of the district was principally old tailings (silver-lead) (8,649 tons) from the Sierra-Nevada property, old zinc-lead tailings (7,500 tons) from Brown Flats near Kellogg, and zinc-lead-silver ore (7,265 tons) from the Sidney mine on Pine Creek.

VALLEY COUNTY

Deadwood Basin district.—Mining and milling were continuous throughout the year at the Hall-Interstate property, operated by the Callahan Zinc-Lead Co. The company reported that 18,934 tons of zinc-lead-silver ore were treated by flotation in 1943, yielding 539 tons of silver-lead-copper concentrates and 1,358 tons of zinc concentrates.

Yellow Pine district.—The open pit at the Yellow Pine mine at Stibnite was worked continuously in 1943 by the Bradley Mining Co.; 178,747 tons of ore (containing an average of about 0.04 ounce of gold and 1.16 ounces of silver to the ton, and some antimony and tungsten) were treated in the company 600-ton flotation mill and yielded both high-grade and low-grade tungsten concentrates, 8,027 tons of antimony-silver-gold concentrate, and 1,902 tons of gold-silver-antimony-iron concentrate. The property was the largest producer of antimony and tungsten in Idaho in 1943 and ranked third in gold.

WASHINGTON COUNTY

The only output in Washington County in 1943 was 107 tons of crude silver-copper ore from the Egan and Silver Still mines in the Washington (Mineral Creek) district.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA

(MINE REPORT)

By G. E. Woodward and Paul Luff

SUMMARY OUTLINE

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SUMMARY

Copper remained the chief source of metal value in Montana in 1943, representing about two-thirds of the State total, and was the only metal to show an increase. The total value of the gold, silver, copper, lead, and zinc produced from Montana ores and gravels was, in terms of recovered metals, $53,642,658 in 1943, compared with $60,129,853 in 1942. (See fig. 1.) This decrease was due to smaller output of each metal, for, although the average prices paid for copper, lead, and zinc were all higher than in 1942, only the value of copper output showed a gain. Gold and silver production was cut drastically by the further closing of gold mines in Montana. Production of lead and zinc declined owing to the idleness at the Anaconda Copper Mining Co. zinc mines at Butte and to the closing of two of the formerly large zinc and lead producers. The tonnage of copper material treated was greater than in 1942, but a relatively larger part of the total tonnage was from dumps, old tailings, and old slime ponds. Silver Bow County, which yielded virtually all the copper output of the State and most of the silver, produced gold, silver, copper, lead, and zinc valued at $42,100,656 in 1943, compared with $46,942,464 in 1942. The decrease was the net result of smaller output of all metals by the Anaconda Copper Mining Co.

Maximum base-metal output from mines in Montana was not reached in 1943, principally because of labor shortages which were particularly acute during summer months and prevailed throughout the mining districts of the State. To alleviate this shortage, the Army again furloughed soldiers for work in the base-metal mines. Of the total soldiers released in 1943, the Anaconda Copper Mining Co. received 800 for work in the copper mines at Butte.

The Government policy of premium payments for overquota production of base metals was in force throughout 1943; however, the War Production Board took certain steps to restrict the output of marginal producers. The Board acted because of increased mineral production, revised military requirements, a greater need for marginal manpower than marginal minerals, and the success of efforts toward balancing supply with the requirements of the armed forces and the most essential civilian needs. Accordingly, the following actions were taken: On October 27, the Board announced that premium prices in the B and C ranges for zinc mines and the B range for lead mines had been denied to mines not already operating or to mines having a low labor productivity and in areas of serious labor shortage; and that the Government would not finance new zinc projects. On November 9, it announced that, effective December 31, no consideration would be given to applications for the special copper premiums under the plan effective since May 1, 1943.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67 + ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Montana, 1939–43, and total, 1862–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	594	282	3,792,780	264,173	$9,246,055	9,087,571	$6,168,533
1940	687	285	5,099,241	272,602	9,541,070	12,361,050	8,790,080
1941	612	325	5,642,249	246,475	8,626,625	12,386,925	8,808,480
1942	370	170	5,678,280	146,892	5,141,220	11,188,118	7,955,995
1943	227	45	5,873,016	59,586	2,085,510	8,450,370	6,009,152
1862–1943			(1)	16,886,996	875,498,072	732,841,398	535,161,819

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	195,654,000	$20,348,016	33,110,000	$1,556,170	69,598,000	$3,619,096	$40,937,870
1940	252,782,000	28,564,366	46,072,000	2,303,600	105,174,000	6,625,962	55,825,078
1941	256,072,000	30,216,496	42,518,000	2,423,526	121,420,000	9,106,500	59,181,627
1942	282,388,000	34,168,948	40,100,000	2,686,700	109,430,000	10,176,990	60,129,853
1943	269,050,000	34,976,500	32,648,000	2,448,600	75,212,000	8,122,896	53,642,658
1862–1943	[2] 6,313,176	1,827,044,910	[2] 663,616	71,642,968	[2] 1,791,988	273,091,316	3,082,439,085

[1] Figures not available.

[2] Short tons.

Gold and silver produced at placer mines in Montana, 1939–43, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating [1]		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1939	2,075	232	208	20	9,164	2,722	9,737	1,937	33,815	6,723	54,999	11,634
1940	2,163	272	281	41	11,252	2,640	11,439	1,302	39,012	7,400	64,147	11,655
1941	2,305	353	139	17	14,663	2,408	10,660	833	33,844	6,424	61,611	10,035
1942	2,732	356	-------	-------	3,674	434	3,553	407	31,283	5,740	41,242	6,937
1943	486	51	7	-------	-------	-------	-------	-------	13,579	1,299	14,072	1,350

[1] Floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

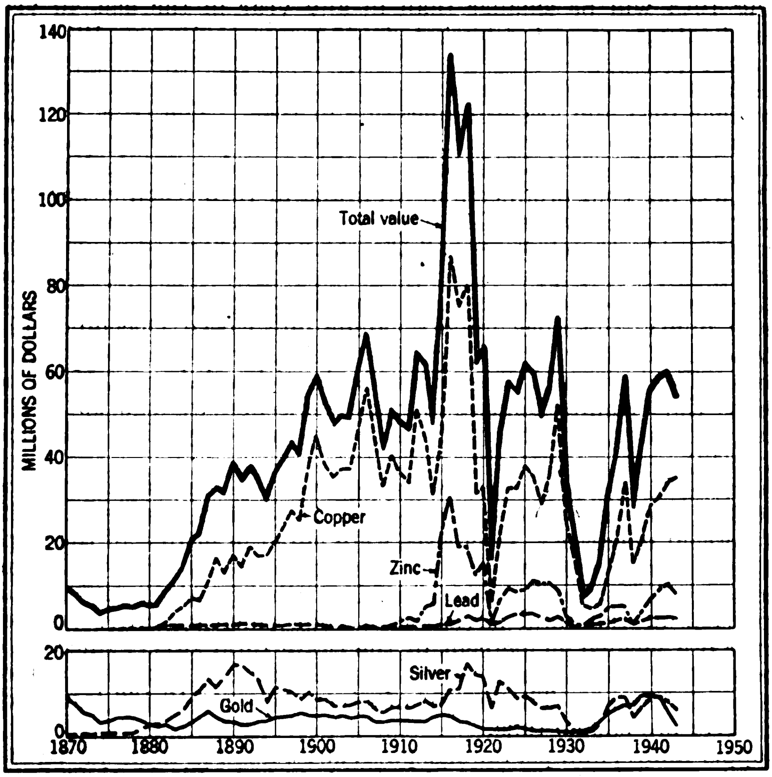

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Montana, 1870–1943.

Gold.—Montana ores and gravels yielded 59,586 fine ounces of gold in 1943, compared with 146,892 ounces in 1942—a 59-percent decrease; the output from lode mines decreased 60,136 ounces and from placer mines 27,170 ounces. Siliceous ores yielded 46 percent of the State total gold, and base-metal ores 30 percent; there was a decrease in gold from each class of ore. Gold production from every county in the State except Flathead and Judith Basin showed a decrease, but both of these counties are of negligible importance as gold producers. The largest decreases were noted from mines in Madison, Broadwater, Jefferson, Park, Lewis and Clark, Silver Bow, and Granite Counties. Gold ore mined totaled 72,616 tons, compared with 322,140 tons in 1942, and comprised 34,926 tons treated in amalgamation and cyanidation mills, 12,666 tons in concentrating mills, and 25,024 tons shipped crude to smelters. Ore treated at amalgamation and cyanidation mills (with or without concentrating equipment) yielded 16 percent of the State total gold; ore concentrated, 32 percent; ore of all classes shipped crude to smelters, 28 percent; and placers, 24 percent.

Virtually all gold mines in Montana were closed by the end of 1943; only those remained active that could justify their operation by reason of supplying smelters with much-needed flux. From records based upon the first 4 months of 1944, gold production in Montana during 1944 will be smaller than in any year in the last 40 years. Three floating connected-bucket dredges were active in 1943; however, one of these—Porter Bros. Corporation dredge—ceased operations August 8, 1943. The other two remained in operation through December 1943 and are still operating in 1944. The H. & H. Mines Co. dredge recovers gold and scheelite, and the Perry-Schroeder Mining Co. dredge recovers gold, sapphires, and some platinum.

The leading gold producers in Montana in 1943 (each either closed during 1943 or active in 1944 only because of special product mined or contained in the ore) were all the company-operated copper mines of the Anaconda Copper Mining Co. at Butte, the Perry-Schroeder dredge (gold and sapphires) on the Missouri River in Lewis and Clark County, the Boaz mine (cyanide mill closed December 1943) in Madison County, the Golden Sunlight mine (siliceous flux) in Jefferson County, the Porter Bros. dredge (closed August 1943) near Helena, the Granite-Bimetallic mine (siliceous tailings as flux) in Granite County, and the Ohio Keating mine (cyanide mill closed July 1943).

Silver.—The output of recoverable silver in Montana in 1943 was 8,450,370 fine ounces, compared with 11,188,118 ounces in 1942—a 24-percent decrease. Decreases were noted in nearly all the important silver-producing counties; the largest were in Silver Bow, Cascade, Granite, and Flathead. Ore treated at concentrating mills yielded 84 percent of the total silver, and crude smelting ore 15 percent. Copper ore yielded 71 percent of the State total silver; siliceous ore 15 percent; zinc-lead ore 12 percent; and lead ore, zinc ore, and placers together 2 percent. The output of silver ore was 140,466 tons and of gold-silver ore 53,890 tons.

Copper mines, dumps, tailings piles, and slime ponds (at Anaconda), zinc mines at Butte, and the Flathead mine in Flathead County—all operated by the Anaconda Copper Mining Co.—produced 78 percent of the total silver in 1943. Other large producers included the Emma mine at Butte (all byproduct silver), the Granite-Bimetallic mine (tailings) in Granite County, the St. Joseph Lead Co. property (zinc-lead ore) (closed in October 1943) in Judith Basin County, the Mike Horse mine (zinc-lead ore) in Lewis and Clark County, and the Elkhorn mine dump in Jefferson County.

Copper.—Copper produced in Montana in 1943, in terms of recovered metal, was 269,050,000 pounds, compared with 282,388,000 pounds in 1942—a 5-percent decrease. The Anaconda Copper Mining Co., which again was the only important copper producer in Montana, treated a greater tonnage of copper material in 1943 but of lower copper content. All the copper mines at Butte are owned and operated by the Anaconda Copper Mining Co. except the property of the North Butte Mining Co., which, in 1943, was operated by the Anaconda Copper Mining Co. through contract agreement. Copper produced from all sources at Butte decreased, except that derived from the treatment of mine dumps and special waste; however, the output of copper from such sources is comparatively small. Copper derived from the treatment of Old and New Works tailings and slime ponds at Anaconda increased. Virtually all the waste materials at Anaconda were derived from the treatment of ore from copper mines at Butte. Copper ore and precipitates yielded gold, silver, and copper valued at $39,330,234, or 73 percent of the total State value.

Lead and zinc.—Both quantity and value of the production of lead and zinc in Montana, in terms of recoverable metal, decreased in 1943—zinc fell 31 percent in quantity and 20 percent in value and lead 19 percent in quantity and 9 percent in value; virtually the entire decrease in lead and all of that in zinc in 1943 were attributable to the closing on May 25, 1942, of all zinc mines at Butte operated by the Anaconda Copper Mining Co., as the output of lead from all other sources in Montana was nearly the same as in 1942 and that of zinc increased. The slag-fuming plant at East Helena, operated by the Anaconda Copper Mining Co., showed an increase of about 731,000 pounds in lead and 7,950,000 pounds in zinc. The Emma mine, operated by the Anaconda Copper Mining Co. under lease, showed a decrease of about 413,000 pounds in byproduct lead and about 1,817,000 pounds in zinc; no zinc-lead ore was mined in 1943.

The leading sources of zinc in 1943, named in order of output, were the slag-fuming plant at East Helena (64 percent of the State total), the Emma byproduct zinc, the Poulin mine at Butte, the Silver Cable mine in Mineral County, the Mike Horse mine in Lewis and Clark County, all Anaconda Copper Mining Co. zinc mines at Butte, the St. Joseph Lead Co. property in Judith Basin County, the Mount Washington mine in Jefferson County, and the Victoria Mining Co. property in Madison County; these nine sources supplied 95 percent of the State total.

The leading lead producers in 1943 were the Emma byproduct lead, the Mike Horse mine in Lewis and Clark County, the slag-fuming plant at East Helena, the St. Joseph Lead Co. property in Judith Basin County, the Jack Waite mine in Sanders County, the Mount Washington mine in Jefferson County, the Victoria mine in Madison County, the Elkhorn mine dump in Jefferson County, and the Hecla slag dump in Beaverhead County; these nine sources contributed 77 percent of the State total.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Montana in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Beaverhead	15	1	1, 133	$39, 655	74, 205	$52, 768
Broadwater	21	6	3, 797	132, 895	52, 560	37, 376
Cascade	10	1	501	17, 535	197, 730	140, 608
Fergus	2	1	121	4, 235	90	64
Flathead	2		624	21, 840	490, 050	348, 480
Granite	10	6	5, 240	183, 400	278, 325	197, 920
Jefferson	43		7, 392	258, 720	294, 120	209, 152
Judith Basin	4		270	9, 450	211, 680	150, 528
Lewis and Clark	31	10	14, 031	491, 085	261, 000	185, 600
Lincoln	4	2	58	2, 030	1, 125	800
Madison	37	3	8, 631	302, 085	41, 760	29, 696
Meagher	2				1, 035	736
Mineral	3	2	15	525	18, 090	12, 864
Missoula	5	3	148	5, 180	1, 620	1, 152
Park	2	4	1, 304	45, 640	17, 055	12, 128
Powell	6	4	75	2, 625	5, 445	3, 872
Ravalli	1		73	2, 555	1, 530	1, 088
Sanders	3		41	1, 435	15, 570	11, 072
Silver Bow	26	2	16, 132	564, 620	6, 487, 380	4, 613, 248
	227	45	59, 586	2, 085, 510	8, 450, 370	6, 009, 152
Total, 1942	370	170	146, 892	5, 141, 220	11, 188, 118	7, 955, 995

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	144, 500	$18, 785	1, 395, 800	$104, 685	1, 012, 500	$109, 350	$325, 243
Broadwater	33, 000	4, 290	1, 005, 000	75, 375	223, 500	24, 138	274, 074
Cascade	9, 700	1, 261	1, 067, 600	80, 070	529, 500	57, 186	296, 660
Fergus			200	15			4, 314
Flathead	259, 700	33, 761					404, 081
Granite	158, 800	20, 644	913, 200	68, 490	763, 500	82, 458	552, 912
Jefferson	90, 200	11, 726	2, 750, 000	206, 250	1, 493, 000	161, 244	847, 092
Judith Basin	115, 700	15, 041	3, 217, 200	241, 290	1, 442, 000	155, 736	572, 045
Lewis and Clark	803, 800	104, 494	10, 001, 800	750, 135	50, 235, 000	5, 425, 380	6, 956, 694
Lincoln	1, 000	130	44, 800	3, 360	57, 000	6, 156	12, 476
Madison	95, 900	12, 467	1, 551, 000	116, 325	1, 093, 500	118, 098	578, 671
Meagher	1, 200	156	50, 600	3, 795			4, 687
Mineral	21, 600	2, 808	721, 200	54, 090	2, 002, 000	216, 216	286, 503
Missoula	12, 400	1, 612	16, 200	1, 215	6, 500	702	9, 861
Park	99, 700	12, 961	79, 000	5, 925	41, 000	4, 428	81, 082
Powell	4, 000	520	81, 800	6, 135	31, 500	3, 402	16, 554
Ravalli	12, 300	1, 599	12, 800	960	15, 000	1, 620	7, 822
Sanders	48, 800	6, 344	3, 160, 400	237, 030	512, 500	55, 350	311, 231
Silver Bow	267, 137, 700	34, 727, 901	6, 579, 400	493, 455	15, 754, 000	1, 701, 432	42, 100, 656
	269, 050, 000	34, 976, 500	32, 648, 000	2, 448, 600	75, 212, 000	8, 122, 896	53, 642, 658
Total, 1942	282, 388, 000	34, 168, 948	40, 100, 000	2, 686, 700	109, 430, 000	10, 176, 990	60, 129, 853

Gold and silver produced at lode mines in Montana in 1943, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Beaverhead	17, 135	806	74, 160
Broadwater	22, 186	3, 778	52, 560
Cascade	41, 267	499	197, 730
Fergus	3, 004	114	90
Flathead	20, 445	624	490, 050
Granite	65, 953	3, 208	278, 190
Jefferson	100, 551	7, 392	294, 120
Judith Basin	51, 468	270	211, 680
Lewis and Clark	208, 536	2, 396	259, 830
Lincoln	2, 368	42	1, 125
Madison	42, 232	8, 627	41, 760
Meagher	75		1, 035
Mineral	10, 409	13	18, 090
Missoula	364	143	1, 620
Park	10, 490	1, 292	17, 055
Powell	2, 374	70	5, 445
Ravalli	1, 111	73	1, 530
Sanders	19, 082	41	15, 570
Silver Bow	5, 163, 966	16, 126	6, 487, 380
	5, 873, 016	45, 514	8, 449, 020
Total, 1942	5, 678, 280	105, 650	11, 181, 181

Gold and silver produced at placer mines in Montana in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating [1]		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Beaverhead	327	45									327	45
Broadwater	19										19	
Cascade	2										2	
Fergus	7										7	
Granite	36		5						1,991	135	2,032	135
Lewis and Clark	45	6	2						11,588	1,164	11,635	1,170
Lincoln	16										16	
Madison	4										4	
Mineral	2										2	
Missoula	5										5	
Park	12										12	
Powell	5										5	
Silver Bow	6										6	
	486	51	7						13,579	1,299	14,072	1,350
Total, 1942	2,732	356			3,674	434	3,553	407	31,283	5,740	41,242	6,937

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

MINING INDUSTRY

The Bureau of Mines gave engineering assistance and performed development and exploration on several mines in Montana. Exploratory work consisted mainly of diamond drilling and drifting to explore extensions of and to develop known mineral-bearing zones. Several thousand tons of copper ore and zinc-lead ore were made available through this work.

Although the Anaconda Copper Mining Co. treated a slightly smaller quantity of crude ore from all copper mines at Butte than in 1942 it treated a greater quantity of waste dumps, tailings, and slimes, and the copper, gold, and silver content of all material treated was generally lower than in 1942. Furthermore, there was no regular output from all zinc mines at Butte in 1943. As a net result of these deficiencies, the State output of copper, lead, and zinc was adversely affected. The closing of many mines producing siliceous ores and the curtailment of production at others, plus a smaller production from mines at Butte, caused the silver production of the State to decrease. Gold lode and placer mines continued to close throughout Montana in 1943, causing a further sharp drop in gold production. Metals from ores amalgamated and cyanided declined in 1943. A greater tonnage of crude ore was smelted direct, but the gold and silver content was substantially smaller than in 1942.

Decreases of 27,170 ounces in gold and 5,587 ounces in silver were noted in the yield from placer mines. Three connected-bucket floating dredges were active in 1943; they treated 3,215,759 cubic yards of gravel and recovered gold valued at $475,265, indicating an average recoverable gold value of 14.8 cents per cubic yard treated. No dragline floating or dry-land dredges were active in Montana in 1943.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Montana in 1943, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	70	72, 616	21, 294	26, 069	195, 528	177, 511	----------
Dry and siliceous gold-silver ore	24	53, 890	3, 874	267, 433	131, 037	717, 178	15, 000
Dry and siliceous silver ore	47	140, 466	2, 216	1, 006, 598	1, 216, 499	2, 375, 803	----------
	141	266, 972	27, 384	1, 300, 100	1, 543, 064	3, 270, 492	15, 000
Copper ore	14	5, 068, 865	14, 355	6, 012, 808	[1] 265, 784, 878	----------	----------
Lead ore	67	8, 449	1, 056	81, 881	41, 635	2, 608, 376	----------
Zinc ore	5	[2] 234, 361	58	45, 375	64, 202	5, 277, 758	49, 290, 942
Zinc-lead ore	34	294, 369	2, 661	1, 008, 856	1, 616, 221	21, 491, 374	25, 906, 068
Total, lode mines	[3] 227	5, 873, 016	45, 514	8, 449, 020	[1] 269, 050, 000	32, 648, 000	75, 212, 000
Total, placers	45	----------	14, 072	1, 350	----------	----------	----------
	272	5, 873, 016	59, 586	8, 450, 370	[1] 269, 050, 000	32, 648, 000	75, 212, 000
Total, 1942	540	5, 678, 280	146, 892	11, 188, 118	[4] 282, 388, 000	40, 100, 000	109, 430, 000

[1] Includes 4,369,199 pounds recovered from precipitates.

[2] Includes 225,261 tons of current slag fumed.

[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[4] Includes 5,327,407 pounds recovered from precipitates.

METALLURGIC INDUSTRY

The 5,873,016 tons of ore produced from Montana lode mines in 1943 were treated as follows: 3,346 tons at amalgamation mills, 31,580 tons at cyanidation mills, 5,327,448 tons at concentrating mills, 285,381 tons shipped direct to smelters, and 225,261 tons of slag fumed.

Two cyanide-concentration mills and one straight cyanide mill were active in Montana in 1943. One mill reported that 10,730 tons of gold ore were treated, consuming 14,000 pounds of sodium cyanide, 6,000 pounds of zinc dust, and 96,831 pounds of lime. The three cyanide mills—both with and without concentrating equipment—reported a total of 31,580 tons of gold ore treated, which contained 9,908 ounces of gold and 4,465 ounces of silver; 4,824 ounces of gold and 1,560 ounces of silver were recovered from cyanide bullion, and 4,269 ounces of gold and 1,663 ounces of silver were recovered from concentrates, indicating a total over-all recovery of 92 percent of the gold and 72 percent of the silver.

A total of 5,327,448 tons of ore of all classes was treated in straight concentration plants in 1943, compared with 4,977,953 tons in 1942. The 1943 total comprised 44,451 tons of siliceous ores, 4,988,691 tons of copper ore, 208 tons of zinc ore, and 294,098 tons of zinc-lead ore.

The Anaconda Copper Mining Co. operated its electrolytic zinc plants at Anaconda and Great Falls without interruption in 1943. The Anaconda section had 5 units and the Great Falls section, 10 units. The total rated capacity of the 15 units is about 245,000 tons of slab zinc per year. In 1943, the average unit production in slab zinc per month was about 2,721,500 pounds; in addition, zinc dross was produced at a rate of about 31,200 pounds of contained zinc per unit per month, making a total of 2,752,700 pounds of zinc per month. The dross was sold to other plants for their use. Zinc concentrates were received and treated from most of the Western States, but chiefly from Idaho, Utah, Montana, Washington, Nevada, New Mexico, and California. In addition to domestic concentrates treated, the Anaconda and Great Falls plants treated about 264,000 tons of zinc concentrates from foreign sources, chiefly upon a toll basis, for accounts of the Metals Reserve Co., United States Smelting, Refining & Mining Co., and American Zinc Co. These concentrates originated from mines in Canada, Mexico, Peru, Chile, and Australia, as follows: Canada, 32,000 tons; Mexico, 114,000; Peru, 22,000; Chile, 31,000; and Australia, 65,000 tons.

The Metals Reserve Co. maintains a stock pile of zinc concentrates at Anaconda, which are received into the Anaconda Copper Mining Co. account as smelting capacity permits. At Anaconda the copper smelter operated continuously in 1943. The company has three concentrating units at Anaconda—a copper concentrator with a rated capacity of about 12,320 tons of ore per day, a zinc concentrator with a rated capacity of 2,000 tons per day, and a slime-disintegrating plant (new in 1943) with a daily rated capacity of 1,500 tons. The copper concentrator is divided into two mills—the west mill and the east mill; the west mill has three identical sections, and the east mill has four sections; both mills treated only copper material in 1943. The zinc concentrator treated zinc-lead ore, both company and custom; sulfide concentrates from manganese ores; and, when not treating zinc ores, the crushing and grinding equipment was used for treatment of copper mine dumps from Butte. The slime-disintegrating plant treats slime deposits. The American Smelting & Refining Co. operated its lead smelter at East Helena continuously in 1943, except for a brief period in October when the plant was shut down, principally for repairing and cleaning the flue systems.

Details of the treatment of all ores produced in Montana in 1943 are given in the tables that follow.

Mine production of metals in Montana in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	757	273	18			
Ore and old tailings cyanided	16,623	4,824	1,560			
Concentrates smelted [1]	585,456	23,469	7,118,583	257,818,920	22,230,145	25,907,192
Copper precipitates smelted	3,758			4,369,199		
Ore smelted	285,381	16,948	1,295,298	6,861,881	5,822,044	974,808
Slag fumed	225,261		33,561		4,595,811	48,330,000
Placer		14,072	1,350			
		59,586	8,450,370	269,050,000	32,648,000	75,212,000
Total, 1942		146,892	11,188,118	282,388,000	40,100,000	109,430,000

[1] Includes zinc concentrates treated at electrolytic plants.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Montana in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Broadwater	696	214	10					
Jefferson	142	42	3	1	1	10		423
Madison	2,500	6	2	142	366	3,363		
Missoula	2	5						
Powell	6	6	3					
	3,246	273	18	143	367	3,373		423
Total, 1942	12,773	956	207	616	1,793	579	11,106	1,786

CYANIDATION MILLS

County	Ore treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Broadwater	15,032	1,109	248	1,955	1,176	481	1,985	
Fergus	3,000	106	83					
Madison	13,548	3,609	1,229	442	3,093	1,182	600	33,358
	31,580	4,824	1,560	2,397	4,269	1,663	2,535	33,358
Total, 1942	239,166	27,061	66,202	3,560	7,610	2,324	2,000	
Grand total; 1943	34,926	5,097	1,578	2,540	4,636	5,036	2,535	33,781
1942	251,989	28,017	66,409	4,176	9,403	2,903	13,106	1,786

Mine production of metals from concentrating mills in Montana in 1943, by counties; in terms of recovered metals

County	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaverhead	441	215	2	1,704	4,357	68,465	74,000
Broadwater	1,893	744	141	16,335	11,881	250,011	223,500
Cascade	41,249	2,249	498	193,319	9,700	1,060,388	529,500
Granite	22,759	1,391	14	33,703	39,000	627,006	763,500
Jefferson	43,900	2,640	203	64,993	39,869	842,933	1,493,000
Judith Basin	51,356	5,229	241	210,884	108,564	3,215,463	1,442,000
Lewis and Clark	61,293	7,200	253	200,623	754,427	4,897,191	1,905,000
Lincoln	2,368	147	42	1,125	1,000	44,800	57,000
Madison	22,304	2,168	906	19,393	40,435	931,123	1,061,500
Mineral	10,406	2,406	13	18,038	21,600	720,551	2,002,000
Missoula	16	5		44	88	1,786	2,192
Park	10,232	425	1,290	9,506	99,100	30,304	41,000
Powell	2,249	134	17	4,951	1,100	75,849	31,500
Ravalli	1,017	86	50	1,104	7,745	12,800	15,000
Sanders	18,727	2,483	28	14,132	42,905	2,838,294	512,500
Silver Bow	5,037,238	555,394	15,135	6,324,793	256,634,614	6,579,400	15,754,000
	5,327,448	582,916	18,833	7,113,547	257,816,385	22,196,364	25,907,192
Total, 1942	4,977,953	677,540	31,979	9,315,748	273,852,223	30,246,157	67,549,300

Gross metal content of concentrates produced from ore mined in Montana in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	2,847	4,646	5,034	2,999	34,707	----------
Dry silver	150	141	22,854	959	8,363	9,114
Copper	531,671	15,628	5,932,785	257,878,839	----------	----------
Lead	13,449	1,458	576,783	484,479	14,376,957	1,787,079
Lead-copper	4,905	165	187,325	742,370	4,883,836	654,739
Zinc	27,629	1,176	354,362	587,406	3,452,611	25,149,644
Zinc-lead	2,644	132	26,404	19,261	439,633	2,729,334
Dry iron (from zinc-lead ore)	2,461	147	18,382	37,898	178,562	436,501
	585,456	23,493	7,123,929	259,754,211	23,374,669	30,766,411
Total, 1942	681,716	41,882	9,318,651	277,597,576	32,667,259	79,201,917

Mine production of metals from Montana concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaverhead	215	2	1,704	4,357	68,465	74,000
Broadwater	2,699	1,317	15,816	13,816	250,011	223,500
Cascade	2,249	498	193,319	9,700	1,060,388	529,500
Granite	1,391	14	33,703	39,000	627,006	763,500
Jefferson	2,641	204	65,003	39,869	843,356	1,493,000
Judith Basin	5,229	241	210,884	108,564	3,215,463	1,442,000
Lewis and Clark	7,200	253	200,523	754,427	4,897,191	1,905,000
Lincoln	147	42	1,125	1,000	44,800	57,000
Madison	2,752	4,365	23,938	41,035	964,481	1,061,500
Mineral	2,406	13	18,038	21,600	720,551	2,002,000
Missoula	5	----------	44	88	1,786	2,192
Park	425	1,290	9,506	99,100	30,304	41,000
Powell	134	17	4,951	1,100	75,849	31,500
Ravalli	86	50	1,104	7,745	12,800	15,000
Sanders	2,483	28	14,132	42,905	2,838,294	512,500
Silver Bow	555,394	15,135	6,324,793	256,634,614	6,579,400	15,754,000
	585,456	23,469	7,118,583	257,818,920	22,230,145	25,907,192
Total, 1942	681,716	41,382	9,318,651	273,865,329	30,247,943	67,549,300

BY CLASSES OF CONCENTRATES

Dry gold	2,547	4,646	5,034	2,535	33,358	----------
Dry silver	150	141	22,854	806	8,028	----------
Copper	531,671	15,628	5,932,785	256,168,068	----------	----------
Lead	13,449	1,458	576,783	410,716	13,810,880	152,628
Lead-copper	4,905	165	187,325	630,885	4,688,483	----------
Zinc	27,629	1,152	349,016	555,684	3,107,435	23,297,215
Zinc-lead	2,644	132	26,404	18,251	412,184	2,457,349
Dry iron (from zinc-lead ore)	2,461	147	18,382	31,975	169,827	----------
	585,456	23,469	7,118,583	257,818,920	22,230,145	25,907,192

Gross metal content of Montana crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	25, 024	9, 573	14, 954	71, 397	60, 177	----------
Dry and siliceous gold-silver	52, 773	3, 823	266, 284	128, 668	777, 207	----------
Dry and siliceous silver	109, 798	1, 843	837, 432	1, 535, 438	1, 886, 632	----------
Copper	80, 174	592	83, 207	5, 404, 581	----------	----------
Lead	8, 449	1, 056	81, 881	51, 790	2, 717, 078	50, 496
Zinc	8, 892	50	10, 038	73, 670	685, 576	1, 471. 985
Zinc-lead	271	11	1, 502	1, 692	44, 787	56, 348
	285, 381	16, 948	1, 295, 298	7, 267, 236	6, 171, 457	1, 578, 829
Total, 1942	244, 026	36, 251	1, 768, 711	3, 593, 520	6, 349, 732	2, 382, 291

Mine production of metals from Montana crude ore shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaverhead	16, 694	804	72, 456	140, 143	1, 327, 335	938, 500
Broadwater	4. 565	1, 138	36, 486	19, 184	754, 989	----------
Cascade	18	1	4, 411	----------	7, 212	----------
Fergus	4	8	7	----------	200	----------
Flathead	20, 445	624	490, 050	259, 700	----------	----------
Granite	43, 194	3, 194	244, 487	119, 800	286, 194	----------
Jefferson	56, 509	7, 146	229, 114	50, 331	1, 906, 644	----------
Judith Basin	112	29	796	7, 136	1, 737	----------
Lewis and Clark	11, 982	2, 143	25, 746	49, 373	508, 798	----------
Madison	3, 880	647	16, 591	54, 865	586, 519	32, 000
Meagher	75	----------	1, 035	1, 200	50, 600	----------
Mineral	3	----------	52	----------	649	----------
Missoula	346	138	1, 576	12, 312	14, 414	4, 308
Park	258	2	7, 549	600	48, 696	----------
Powell	119	47	491	2, 900	5, 951	----------
Ravalli	94	23	426	4, 555	----------	----------
Sanders	355	13	1, 438	5, 895	322, 106	----------
Silver Bow	126, 728	991	162, 587	6, 133, 887	----------	----------
	285, 381	16, 948	1, 295, 298	6, 861, 881	5, 822, 044	974, 808
Total, 1942	244, 026	36, 251	1, 768, 711	3, 195, 264	5, 987, 057	1, 500, 700

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	25, 024	9, 573	14, 954	68, 241	57, 691	----------
Dry and siliceous gold-silver	52, 773	3, 823	266, 284	122, 873	704, 378	----------
Dry and siliceous silver	109, 798	1, 843	837, 432	1, 206, 204	1, 732, 335	----------
Copper	80, 174	592	83, 207	5, 358, 840	----------	----------
Lead	8, 449	1, 056	81, 881	41, 635	2, 608, 376	----------
Zinc	8, 892	50	10, 038	62, 647	675, 241	938, 500
Zinc-lead	271	11	1, 502	1, 441	44, 023	36, 308
	285, 381	16, 948	1, 295, 298	6, 861, 881	5, 822, 044	974, 808

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Montana in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Beaverhead County:													
Argenta	8		3, 264	110		110	8, 536		8, 536	13, 900	538, 600	74, 000	$60, 114
Bannack	2		379	364		364	14		14				12, 750
Bryant	1		12, 454	324		324	46, 904		46, 904	127, 500	828, 200	938, 500	224, 742
Horse Prairie Creek or Colorado	1	1	81	2	327	329	495	45	540		28, 200		14, 014
Vipond	3		957	6		6	18, 211		18, 211	3, 100	800		13, 623
Broadwater County:													
Backer		2			3	3							105
Beaver	8		1, 856	864		864	36, 706		36, 706	27, 000	581, 000	157, 500	120, 437
Cedar Plains	8	3	16, 302	2, 324	6	2, 330	4, 417		4, 417	3, 400	235, 600		102, 803
Park or Indian Creek	5	1	4, 028	590	10	600	11, 437		11, 437	2, 600	188, 400	66, 000	50, 729
Cascade County:													
Barker[1]	1		360	2		2	1, 575		1, 575		49, 600	123, 000	18, 194
Clark Fork of Yellowstone River		1			2	2							70
Montana	9		40, 907	497		497	196, 155		196, 155	9, 700	1, 018, 000	406, 500	278, 396
Fergus County:													
North Moccasin	1	1	3, 000	106	7	113	83		83				4, 014
Warm Springs	1		4	8		8	7		7		200		300
Flathead County: Hog Heaven	2		20, 445	624		624	490, 050		490, 050	259, 700			404, 081
Granite County:													
Boulder and South Boulder	1		170	2		2	1, 215		1, 215	800	2, 400	10, 500	2, 352
Dunkleberg	1		22, 537	11		11	31, 417		31, 417	38, 200	623, 800	747, 000	155, 153
First Chance	1	5	12		41	41				500			1, 500
Flint Creek	6		43, 212	3, 195		3, 195	245, 447		245, 447	119, 300	279, 000	6, 000	323, 447
Henderson		1			1, 991	1, 991		135	135				69, 781
Maxville	1		22				111		111		8, 000		679
Jefferson County:													
Amazon	3		317	35		35	1, 748		1, 748	3, 200	18, 000		4, 234
Boulder and Little Boulder	3		322	16		16	1, 471		1, 471	1, 400	31, 400		4, 143
Cataract	17		5, 087	426		426	23, 376		23, 376	14, 100	230, 000	51, 500	56, 178
Colorado	5		55, 007	652		652	104, 400		104, 400	45, 300	1, 302, 200	1, 441, 500	356, 296
Elkhorn	3		22, 730	577		577	156, 915		156, 915	18, 900	918, 600		203, 131
Montana City	2		9	8		8	239		239	400			502
Warm Springs	1		24	50		50	149		149	100	400		1, 899
Whitehall	8		16, 866	5, 327		5, 327	4, 929		4, 929	5, 700	237, 400		208, 496
Wilson and Ticer Creeks	1		189	301		301	893		893	1, 100	12, 000		12, 213
Judith Basin County:													
Barker[1]	2		51, 344	240		240	211, 050		211, 050	107, 900	3, 217, 200	1, 442, 000	569, 533
Yogo	2		124	30		30	630		630	7, 800			2, 512

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[1] Barker district lies in Cascade and Judith Basin Counties.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1943, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Lewis and Clark County:													
Blue Cloud	1		3				31		31		600		$67
Dry Gulch	2		33	28		28	121		121		200		1, 081
Greenhorn		1			2	2							70
Heddleston	1		57, 809	130		130	198, 104		198, 104	732, 800	4, 700, 200	1, 905, 000	798, 943
Helena	3	8	136	13	4, 724	4, 737	734	405	1. 139	400	6, 200		167, 122
Marysville	9		7, 018	1, 862		1, 862	7, 124		7, 124	26, 400	257, 800		93, 003
Missouri River		1			6, 909	6, 909		765	765				242, 359
Rimini	5		1, 245	273		273	17, 429		17, 429	6, 700	258, 000		42, 170
Scratch Gravel	4		132	60		60	104		104	100			2, 187
Smelter	3		232, 124	12		12	36, 166		36, 166	36, 800	4, 778, 800	48, 330, 000	5, 608, 972
Stemple-Gould	2		33	18		18	14		14	100			653
Wolf Creek	1		3				3		3	500			67
Lincoln County:													
Libby	2	2	2, 143	42	16	58	983		983	600	33, 000	37, 500	9, 332
Troy or Grouse Mountain	2		225				142		142	400	11, 800	19, 500	3, 144
Madison County:													
McCarthy Mountain	1		313	13		13	2, 925		2, 925	200	170, 800		15, 371
Norris and Norwegian	7	1	11, 809	6, 600	1	6, 601	2, 489		2, 489	600	33. 600		235, 403
Pony and South Boulder	2		1, 625	568		568	886		886	10, 300	1, 800		21, 984
Renova	2		187	142		142	301		301	500			5, 249
Rochester	7		1, 456	108		108	9, 194		9, 194	2, 800	296, 400	56, 000	38, 960
Sheridan	5		22, 124	398		398	18, 692		18, 692	81, 000	994, 000	1, 037, 500	224, 352
Silver Star	4		4, 409	694		694	3, 666		3. 666	100	2, 600		27, 105
Tidal Wave	4		127	46		46	952		952	100	51, 400		6, 155
Virginia City	4	2	160	32	3	35	2, 610		2, 610	300			3, 120
Washington	1		22	26		26	45		45		400		972
Meagher County:													
Castle Mountain	1		70				1, 035		1, 035		50, 600		4, 531
Spring Creek	1		5							1, 200			156
Mineral County:													
Cedar and Trout Creeks		2			2	2							70
Packer Creek	3		10, 409	13		13	18, 090		18, 090	21, 600	721, 200	2, 002, 000	286, 433
Missoula County:													
Coloma	2		99	132		132	128		128				4, 711
Copper Cliff	1		4				24		24		2, 800		227
Nine Mile	1	3	55		5	5	163		163	600	6, 600	6, 500	1, 566
Wallace	1		206	11		11	1, 305		1, 305	11, 800	6, 800		3, 357
Park County:													
Emigrant Creek		4			12	12							420
New World	2		10, 490	1, 292		1, 292	17, 055		17, 055	99, 700	79, 000	41, 000	80, 662

Powell County:													
Big Blackfoot	1		25	8		8	66		66		2,200		492
Finn		1			1	1							35
Nigger Hill	2		2,259	19		19	5,144		5,144	1,100	78,000	31,500	13,718
Ophir Gulch	1		15	3		3	52		52	2,900			519
Pioneer		3			4	4							140
Yourname Creek	1		6	6		6	3		3				212
Zozell	1		69	34		34	180		180		1,600		1,438
Ravalli County: Curlew	1		1,111	73		73	1,530		1,530	12,300	12,800	15,000	7,822
Sanders County:													
Camas Prairie	1		77	1		1	135		135	6,300			820
Eagle	1		18,945	30		30	15,421		15,421	43,500	3,160,400	512,500	310,051
Vermilion	1		60	10		10	14		14				360
Silver Bow County:													
Highland	1		229	103		103	31		31	700			3,718
Lost Child		1			3	3							105
Melrose	1		63	6		6	2,226		2,226				1,793
Summit Valley	24	1	5,163,874	16,017	3	16,020	6,485,123		6,485,123	267,137,000	6,579,400	15,754,000	42,095,040
Total Montana	227	45	5,873,016	45,514	14,072	59,586	8,449,020	1,350	8,450,370	269,050,000	32,648,000	75,212,000	53,642,658

BEAVERHEAD COUNTY

Argenta district.—Old smelter slag containing appreciable quantities of silver, copper, and lead was shipped crude to the Midvale (Utah) concentrator from the Annie Placer in 1943 by L. D. Foreman. The Ferdinand mine was operated from January through November, during which period zinc-lead ore was shipped to the Midvale (Utah) concentrator. The remainder of the production in the Argenta district in 1943, all of which was shipped crude to smelters, comprised lead ore from the Iron Mountain, Louis Phillip, Goodreen, Copper Bell, and Sylvia mines, and copper ore from the Goldsmith mine.

Bannack district.—Production from the Bannack district in 1943 comprised siliceous gold ore from the Pioneer and the Bannack Apex mines shipped crude to the Anaconda copper smelter and some mill cleanings high in gold shipped to East Helena.

Bryant district.—A total of 12,454 tons of siliceous gold ore, silver-lead tailings, lead ore, and zinc-lead slag was shipped crude to Montana and Utah smelters in 1943 from the Hecla mine and dump by L. D. Foreman. Included in the total output were 8,892 tons of old smelter slag containing 8.3 percent zinc and 3.9 percent lead plus minor quantities of copper, silver, and gold. The slag was smelted first in the Tooele (Utah) lead blast furnace; the resultant slag was then treated in the slag-fuming furnace at Tooele for recovery of zinc oxide fume. Although a loss of about $5 per ton of material at the smelter was sustained by the shipper, the premium payments for lead and zinc were high enough to make the operation profitable.

Horse Prairie Creek or Colorado district.—Lead ore was shipped crude to East Helena in 1943 from the H & S mine. The Gold Leaf placer on Jeff Davis Creek was operated by sluicing from April to December 1943 and yielded the only placer gold produced in the Horse Prairie district.

Vipond district.—Highly siliceous silver ore, some of which contained enough silica for use as convertor flux, was shipped crude to the Anaconda copper smelter from Quartz Hill Mines in 1943. The remaining output from the Vipond district was crude silver ore shipped direct to smelters from the Monte Cristo and Faithful properties.

BROADWATER COUNTY

Beaver district.—The value of the metal output in 1943 from mines in the Beaver district was virtually the same as in 1942. In 1943, as in 1942, the major part of the production came from the East Pacific and East Pacific Tunnel No. 4. Lead ore and zinc-lead ore, both rich in gold, were shipped to East Helena and the Anaconda zinc concentrator, respectively. Gold ore from the Vosburg property was shipped crude to East Helena. Other production in the district included crude ore shipped direct to smelters, principally from the Edna #2, Custer Group, and Silver King mines.

Cedar Plains district.—The M & M Mining Co. operated its Ohio Keating property until July 25, 1943, when closed by Government order. During the period of operation, the company treated 15,032 tons of gold ore in its 100-ton cyanidation-concentration mill and produced 1,955 tons of gold concentrates, which were shipped to East Helena; and in addition, cyanide bullion was produced that yielded 1,109 ounces of fine gold and 248 ounces of silver. The remainder of the production from the Cedar Plains district in 1943 comprised crude lead ore shipped direct to East Helena from the Dandy Group, North Star Group, Santa Anita claim, Ruby Silver, and Cleo mines, and crude siliceous ores shipped direct to East Helena, chiefly from the Ruby Silver mine.

Park or Indian Creek district.—The Broadwater Zinc & Lead Co. built a 50-ton flotation mill in 1943 on its Iron Mask property and treated approximately 1,200 tons of zinc-lead ore. In addition, the company shipped 1,612 tons of silver ore direct to smelters. Gold ore from the Marietta mine shipped crude to East Helena amounted to 215 tons and contained 316 ounces of gold and 924 ounces of silver. The Diamond Hill amalgamation mill, which was increased to 30-ton capacity, treated 556 tons of gold ore in 1943 from the Diamond Hill mine. Other production included crude gold ore shipped direct to East Helena from the Erickson mine dump and gold ore amalgamated from the Silver Star mine.

CASCADE COUNTY

Barker district.—The only production in 1943 from the Cascade County section of the Barker district was zinc-lead ore from the Fairplay mine, which was shipped to the Midvale (Utah) concentrator for treatment. The property was operated throughout 1943.

Montana district.—The value of the metal output in 1943 from the Montana district was about one-third of that in 1942. The production of all metals showed very substantial decrease in 1943, particularly the silver and gold. The Klies Mining Co. operated its Broadwater group and its 80-ton flotation mill until June 5, when all operations ceased. On July 1, the holdings and assets of the Klies Mining Co. were purchased by the Neihart Mine & Milling Co., which continued operation of the mine and flotation mill during the rest of 1943. Zinc-lead ore from the Broadwater group, treated by the two companies, in 1943 aggregated 12,628 tons compared with 23,783 tons in 1942. The zinc-lead ore treated by the Neihart Mine & Milling Co. had an average content of 2.6 ounces of silver to the ton, 2.6 percent lead, and 3 percent zinc. Ore production was substantially reduced during the latter half of 1943 by shortage of labor.

The Florence Mining Co. operated its Florence mine until April 1943; however, the company 50-ton flotation mill was operated until June 30. During the 6-month period, the company treated about 3,500 tons of silver ore and made lead concentrates rich in silver, which were shipped to East Helena. The company was by far the most important producer of silver in the district in 1943. After operations were suspended June 30, all equipment was sold to the Bennett Mining Co. of Neihart, Mont. The Lexington Mining Co. treated about 3,000 tons of silver ore from its Big Seven mine in its 100-ton flotation mill; the silver concentrates produced contained approximately 1,700 ounces of silver to the ton and were shipped to East Helena. The company ceased operations after July 1943. After the Lexington Mining Co. suspended operations, it leased its mine and mill to the Montana Leasing Co., which treated in the mill 6,460 tons of silver dump ore from the Ripple mine and 5,584 tons of silver ore from the Benton group. A total of 410 tons of silver-lead concentrates was produced. The New London Mining Co. treated about 9,000 tons of silver ore from its Star mine in its 40-ton flotation mill, making 395 tons of lead concentrates rich in silver that were shipped to East Helena. Other production in the Montana district in 1943 included silver ore from the Graham-Hollowbush group concentrated in the Klies Mining Co. mill, crude lead ore shipped to East Helena from the Lizzie property, and zinc-lead ore shipped to the Midvale (Utah) concentrator from the Champion B mine.

FERGUS COUNTY

North Moccasin district.—The North Moccasin Mines Syndicate operated its Barnes-King open-cut mine and 200-ton cyanide mill during January 1943; after this brief period of operation, the property was closed.

Warm Springs district.—A test lot of crude gold ore was shipped in 1943 from Globe mine to the East Helena smelter.

FLATHEAD COUNTY

Hog Heaven district.—Siliceous silver ore shipped crude to the Washoe Sampling Works at Anaconda in 1943 comprised the only output from the Hog Heaven district. The Flathead and West Flathead mines, owned and operated by the Anaconda Copper Mining Co., produced a total of 20,437 tons of silver ore, virtually the entire output of the district.

GRANITE COUNTY

Boulder and South Boulder district.—A lessee operated the Saranac mine from April 16 to August 2, 1943, and treated 170 tons of zinc-lead ore in the 30-ton Saranac flotation mill. A bulk silver-lead-zinc concentrate was produced, which was shipped to the zinc smelter at Anaconda.

Dunkleberg district.—All the output of the Dunkleberg district in 1943 was zinc-lead ore from the Forest Rose, Wasa, and Monarch mines, operated under lease by the Forest Rose Syndicate. The bulk of the production in 1943, however, came from the Forest Rose mine. During the summer months, shortage of manpower became so acute that the management suspended all milling operations for about a month and used the mill men for underground mining and development. A substantial quantity of oxide ore encountered in the development of the properties caused a lower-than-normal mill recovery. In September, a new hoist was installed at the Forest Rose mine. The 80-ton flotation mill was operated throughout 1943, except during the brief shut-down in the summer. An aggregate of 22,537 tons of mine ore and dumps that averaged about 2.7 percent lead and 3.4 percent zinc was treated in 1943, compared with a total of 22,500 tons with about 4 percent lead and 4 percent zinc treated in 1942. The output of zinc and lead concentrates produced was considerably smaller than in 1942.

First Chance district.—A test lot of crude copper ore was shipped direct to the Washoe Sampling Works at Anaconda in 1943 by the Consolidated Mining Co. from the Queen Helen mine of the Mitchell group. The company, a recent incorporation, spent most of the year in development preparatory to mining commercial copper ore in 1944.

Some placer gold was recovered in 1943 by sluicing from stream gravels.

Flint Creek district.—Old tailings from the Granite-Bimetallic dumps continued to be the chief source of metal production in the Flint Creek district in 1943. The Philipsburg Mining Co. was liquidated, and all holdings were purchased by J. C. and Juanita Yob. In 1943 the old tailings were mined and treated in a 400-ton washing and desliming plant; the resulting product was shipped crude to Tacoma and East Helena smelters, to be used there as flux. The Trout Mining Division of American Machine & Metals, Inc., produced chiefly manganese ore in 1943; however, some sorted crude lead, silver, and gold ore was shipped direct to smelters. Joseph T. Farrow, lessee of the Patten Mining Co., operated the Two Per Cent property intermittently in 1943 and shipped crude silver ore to the Washoe Sampling Works at Anaconda and zinc-lead ore to the Anaconda zinc concentrator. The remainder of the output from the Flint Creek district comprised crude ore shipped direct to smelters and came chiefly from the Silver Prince and Comanche Extension mines.

Henderson district.—Gold and scheelite were recovered in 1943 from gravels of Henderson Creek Gulch by dredging. In 1942 H. & H. Mines dismantled its all-electric Yuba (65 3½-cubic foot bucket) dredge, which had been operating on Crooked River near Elk City, Idaho, and moved it to a point on Henderson Creek about 17 miles south of Drummond, Mont. The bucket dredge was reassembled, and active operations were begun on May 2, 1943, and were continued throughout the rest of the year. During the period of operation, 601,809 cubic yards of gold-tungsten-bearing gravels were washed, resulting in the recovery of 1,991 fine ounces of gold, 135 ounces of silver, and some tungsten; the aggregate value of the metals produced was about $100,000. The scheelite in the gravel is derived from a large body of contact-metamorphic rock cut by the canyon of Henderson Creek. Grains of scheelite occur in quartz seams in this rock and are liberated by erosion, eventually becoming concentrated in the stream gravel.

Maxville district.—Lead ore shipped direct to East Helena from the Snow Cap mine was the only output from the Maxville district in 1943.

JEFFERSON COUNTY

Amazon district.—Crude lead ore from the East Mint and Evening Star mines and old gold-silver tailings from the Boulder mine, all shipped direct to East Helena in 1943, comprised the output from the Amazon district.

Boulder and Little Boulder district.—Lead ore from the Summit and Buckhorn mines and silver ore from the Baltimore mine were shipped crude to smelters in 1943.

Cataract district.—Many operations were active in the Cataract district in 1943. R. N. Shute and partners shipped about 2,600 tons of siliceous gold-silver tailings from the Bluebird tailings dump to East Helena for flux. O. O. Alexander shipped 516 tons of zinc-lead ore to the Midvale (Utah) concentrator from the Aurora mine. The Golden Messenger Corporation exercised its option on the Crystal group of mines early in 1943; production amounted to a car of gold-silver ore shipped crude to the Washoe Sampling Works at Anaconda and a car of zinc-lead ore shipped to the Midvale (Utah) concentrator. Among other mines active in 1943 were the Grey Eagle (dump), Copper Bell, Big 4 (dump), Bullion (dump), Morning Glory, Hope, and Eva May.

Colorado district.—The value of metal production from the Colorado district gained 21 percent in 1943 compared with 1942; the output of each metal except gold and copper increased. The Monongahela-Mount Washington Mining Co. operated its Mount Washington property throughout the year, compared with only about 9 months of operation in 1942. During 1943, the company treated about 43,000 tons of zinc-lead ore in its 150-ton flotation mill. The lead concentrates produced were shipped to East Helena, and the zinc concentrates to Amarillo, Tex., for smelting. In addition to the zinc-lead ore milled, the company shipped about 4,800 tons of crude gold-silver ore direct to East Helena. Henry Lancaster, lessee on the dump of the Minah mine, shipped about 6,700 tons of crude gold-silver ore direct to East Helena. The dump material was sold at 50 cents a ton regardless of the assay value of the metals contained. Other production in the Colorado district in 1943 included crude ore shipped to smelters from the Alta, Blue Bird, and Good Hope properties.

Elkhorn district.—The Elkhorn dump was the chief source of metal production in 1943 from the Elkhorn district. A power shovel was used to load the old tailings which were shipped direct to East Helena, there to be used as flux. The material contained an average of 6.9 ounces of silver to the ton, 2.1 percent lead, and 3.0 percent zinc, with minor quantities of gold and copper. The operation was profitable only because of the premium payments received from the Government. Crude ore was shipped direct to East Helena from the Klondyke and Silver Crescent mines.

Montana City district.—A little crude ore was shipped in 1943 to East Helena from the Our Ticket 45 and Margrate mines.

Warm Springs district.—Gold ore shipped crude to East Helena from the War Eagle mine comprised the output in the Warm Springs district in 1943.

Whitehall district.—Marvin Reibhoff operated the Golden Sunlight mine throughout 1943 and shipped over 15,000 tons of highly siliceous gold ore direct to the Washoe Sampling Works at Anaconda. The average silica content of the ore was about 72 percent, sufficient to be of use as convertor flux at the Anaconda copper smelter. A lessee shipped 539 tons of lead ore direct to East Helena from the Perhaps mine. The rest of the district production was crude ore shipped direct to smelters and included siliceous ore from the Lucky Hit and Leah mines and lead ore from the Carbonate, Surprise, Midnight, and Parrott mines.

Wilson and Ticer Creeks district.—Gold ore shipped crude to a smelter, gold ore amalgamated from the Callahan group, and lead ore shipped crude to a smelter comprised the output from the Wilson and Ticer Creeks district in 1943.

JUDITH BASIN COUNTY

Barker district.—Virtually the entire output of the Barker district in 1943 came from the operation of the St. Joseph Lead Co. at its

Block P property. The company operated its property and 400-ton concentrator from January 1 until October 28, 1943, when the property was closed by Government order. During the period of operation, the company treated 33,301 tons of ore containing an average of 7.5 ounces of silver to the ton, about 4.5 percent lead, and 2.47 percent zinc; in addition, 18,035 tons of old tailings were milled and averaged 2.35 ounces of silver to the ton, 0.5 percent lead, and 1.80 percent zinc. Production amounted to about 3,500 tons of lead concentrates and 1,650 tons of zinc concentrates. The Government concluded that the property was a marginal producer and that lead, its principal product, was no longer a critical metal.

Yogo district.—Some crude copper ore from the Gold Bug mine was shipped direct to the Washoe Sampling Works at Anaconda in 1943. Gold ore from the Blue Dick mine was concentrated, making copper concentrates.

LEWIS AND CLARK COUNTY

Dry Gulch district.—Several small lots of old cleanings from the Golden Messenger cyanide mill and one lot of crude siliceous ore from the Juno dump, all shipped direct to East Helena, comprised the output from the Dry Gulch district in 1943.

Heddleston district.—The Mike Horse mine, one of the chief producers of lead and zinc in Montana, was the only mine active in the Heddleston district in 1943. The Mike Horse Mining & Milling Co. operated its mine and 200-ton flotation mill throughout the year, producing more silver, lead, and copper but less gold and zinc than in 1942. A total of about 57,800 tons of zinc-lead-copper ore was treated—somewhat less than in 1942—making 4,845 tons of lead-copper concentrates and 2,056 tons of zinc concentrates. The property and mill were operated at a capacity consistent with the availability of manpower.

Helena district.—Porter Bros. operated its 6-cubic foot electrically powered Yuba dredge from January 1 to August 8, 1943, on the Last Chance Gulch placer just north of Helena. A total of 972,755 cubic yards of gravel was washed in 1943, compared with 1,455,393 in 1942, and supplied nearly all the placer output of the Helena district. Lode production came from the Peck Concentrator dump and the Crescent and Franklin D mines and was siliceous ore shipped crude to East Helena.

Marysville district.—The Montana Rainbow Mining Co., chief producer in the Marysville district, operated the Drumlummon mine throughout 1943 and shipped 2,724 tons of gold ore, containing 1,284 ounces of gold and 3,566 ounces of silver, crude to smelters. Construction of the 160-ton flotation-amalgamation mill, moved from Libby in 1942 to the Drumlummon mine, was not completed owing to the present labor and material scarcity. The Northwest Mining Co. operated the Empire mine and 35-ton Empire flotation mill until September 6, when Martin Bros. assumed control of the mill. Gold ore from the Empire mine was concentrated in the Empire mill, resulting in 179 tons of lead concentrates. In addition, 36 tons of lead ore were shipped crude to East Helena from the property. Martin Bros. treated 2,231 tons of silver ore from the Shakopee mine in the Empire mill and made 120 tons of lead concentrates; the property was active from April 16 to December 31. A lessee operated the Belmont property intermittently in 1943 and shipped 418 tons of crude gold ore to the Washoe Sampling Works at Anaconda. Among other producers active in the district in 1943 were the Tousley, Penobscot, and Nile dump.

Missouri River district.—The Perry-Schroeder Mining Co. operated its 6-cubic foot bucket dredge on the Missouri River throughout 1943 and washed 1,641,195 cubic yards of gold-bearing gravel. No platinum was reported recovered in 1943 from the operation.

Rimini district.—The South Dakota Mining Associates operated on company account and through lessees in 1943; an aggregate of 576 tons of lead ore was shipped crude to East Helena from several properties controlled by the Associates, including the Evergreen, Bunker Hill, and Free Speech mines. The Armstrong Mining Co. worked the Armstrong property on company account and through lessees; the production was lead ore shipped crude to East Helena. Other production in the district in 1943 included crude gold ore from the Aurora and lead ore from the Little Jimmy and Wisconsin mines.

Scratch Gravel district.—Production from mines in the Scratch Gravel district in 1943 comprised gold ore shipped crude to smelters from the Franklin, Nettie, Oom Paul dump, and Magpie properties.

Smelter district.—By far the most important lead and zinc producer in Montana in 1943 was the Anaconda slag-fuming plant at East Helena, owned and operated by the Anaconda Copper Mining Co. The plant was in continuous operation in 1943, except for a short period in October when operations were discontinued pending the completion of repairs and the cleaning out of flue systems at the East Helena lead smelter. The bulk of the slag fumed in 1943 was current hot slag from the East Helena lead smelter, which slag resulted from the smelting of ores, concentrates, and zinc-smelter (electrolytic) lead residues. The company treated a total of 225,261 tons of current slag and cold slag in 1943 and produced zinc-lead fume, the metals in which were valued at approximately $5,588,000. The American Smelting & Refining Co. re-treated approximately 6,800 tons of old gold-silver-copper-lead slag in 1943.

Stemple-Gould district.—Gold ore from the American Boy and Bond Holder mines comprised the production in the Stemple-Gould district in 1943.

LINCOLN COUNTY

Libby district.—Early in 1943 the Standard Silver Lead Mining Co. undertook reconditioning the Snowshoe group of properties and experimenting with the 60-ton Snowshoe flotation mill. During the year approximately 2,100 tons of zinc-lead ore and old tailings were treated, making 59 tons of lead concentrates and 29 tons of zinc concentrates.

Troy or Grouse Mountain district.—The Montana Mining & Milling Co., only company active in the Troy district in 1943, acquired a lease on the Iron Mask and Montana Morning mines and the Giant Sunrise Co. mill building. Flotation equipment capable of treating 25 tons of ore a day was installed. Actual mining operation began about July and continued until November; during this period 225 tons of zinc-lead ore was treated, resulting in 9 tons of lead concentrates and 23 tons of zinc concentrates.

MADISON COUNTY

McCarthy Mountain district.—Herman Mueller operated the B. B. & I. E. property throughout 1943 and shipped 313 tons of lead ore direct to East Helena.

Norris and Norwegian district.—Gold ore cyanided and gold ore shipped crude to smelters comprised the production from the Norris and Norwegian district in 1943. Gold ore treated in the Boaz 50-ton cyanidation-concentration mill on both company and custom account contributed virtually the entire output of the Norris district. The Boaz mine operated its property throughout 1943; however, the mill was operated until December 5 only, when it was closed owing to labor shortage and Government order. The mine will continue to ship crude siliceous gold ore to smelters. During the period of operation, the Boaz mill treated 10,730 tons of gold ore and recovered about 3,400 ounces of gold and 1,165 ounces of silver in cyanide bullion and made 435 tons of rich gold concentrates. Among other producers in the district in 1943 were the Emperor, Bayles, Pearl, and Revenue mines.

Pony district.—Virtually the entire production in the Pony district in 1943 came from the Mammoth mine operated by the Liberty Montana Mines Co. The company treated 1,620 tons of gold ore in its 120-ton flotation-gravity concentration mill, making 187 tons of copper concentrates.

Renova district.—A lessee shipped crude gold and gold-silver ore in 1943 from the Mary Ingaber group of mines direct to a smelter.

Rochester district.—John Potts, lessee, shipped a total of 705 tons of crude lead ore from the Jack Rabbit mine to the Midvale (Utah) and East Helena smelters in 1943. The Commonwealth Lead Mining Co. operated the Calvin mines from January 1 to March 5; during this period 155 tons of lead ore and 232 tons of zinc-lead ore were shipped crude to smelters in Utah and Montana. Camilla Gage, owner of the Emma mine, shipped 205 tons of zinc-lead ore to the Midvale (Utah) concentrator. Other mines in the Rochester district, active in 1943, included the Montrose, King, Thistle, and Leadora.

Sheridan district.—Victoria Mines, Inc., operated the Toledo group of properties in the Sheridan district throughout 1943. The company converted its 120-ton Victoria cyanide mill to flotation for the express purpose of treating zinc-lead ores from the Toledo mine. The mill is at Silverstar, 27 miles from the mine, and all ore is hauled to the mill by trucks. In 1943 the Toledo mine produced 581 tons of oxidized lead ore, which was shipped crude to East Helena, and 20,438 tons of zinc-lead ore, which was milled. The company was by far the largest producer of lead and zinc in the Sheridan district and one of the principal producers in Montana. Crude gold ore from the Dictator mine was shipped direct to the Washoe Sampling Works at Anaconda. A small quantity of gold ore from the Red Pine mine was concentrated in 1943, making gold concentrates. Other production in the district came from the Billy Bennett and Lost Angel mines.

Silver Star district.—The Green-Campbell Mining Co. operated its Green-Campbell mine and 25-ton amalgamation-flotation mill until July 15, 1943, when the property was shut down by Government order. The company treated about 2,500 tons of gold ore, making 142 tons of gold concentrates shipped to the Washoe Sampling Works at Anaconda and some gold bullion shipped to the Seattle Assay Office. Victoria Mines, Inc., closed its Broadway mine and cyanide mill in 1942; however, when the mill was converted from cyanidation to flotation (completed in 1943) cleanings and cyanide bullion were shipped to smelters and mints. The remainder of the district production was gold ore shipped crude to smelters, chiefly from the Stella mine.

Tidal Wave district.—Lead ore was shipped direct to East Helena in 1943 from the Inspiration, Last Chance, Keynote, and Hi-Ridge mines.

Virginia City district.—The lode output in the Virginia City district in 1943 was ore shipped crude to smelters; it included gold-silver ore from the Lone Star mine, gold ore from the Marietta mine, gold-silver and silver ore from the Alder Gulch group, and silver ore from the I. X. L. mine.

Washington district.—Crude gold ore was shipped direct to East Helena in 1943 from the Snowslide mine.

MEAGHER COUNTY

Castle Mountain district.—The Cumberland mine, reported idle since 1892, was reopened by lessees in 1943. Crude ore, which averaged about 38 percent lead and 15 ounces of silver to the ton, was shipped direct to East Helena.

MINERAL COUNTY

Packer Creek district.—The Silver Cable mine, under lease to the Hecla Mining Co. of Wallace, Idaho, was operated in 1943 from July until December 31. The property is accessible during the summer and fall months only, owing to heavy snowfall. About 10,200 tons of zinc-lead ore from the property were treated in 1943 in the Hecla mill at Burke, Idaho, making 448 tons of lead concentrates and 1,939 tons of zinc-lead concentrates; the ore averaged about 12 percent zinc and about 5 percent lead. Operations were resumed at the property in May 1944. Development was carried on continuously in 1943 on the Last Chance mine, and about 200 tons of silver ore were mined and jigged, making 19 tons of silver concentrates. A little lead ore was shipped crude to the Bunker Hill smelter from the Bryan mine.

MISSOULA COUNTY

Coloma district.—Gold ore shipped crude to a smelter from the Mammoth and I. X. L. mines and gold ore amalgamated from the Mammoth mine comprised the output of the Coloma district in 1943.

Nine Mile district.—Zinc-lead ore shipped direct to the Bunker Hill smelter (Idaho) and the Midvale (Utah) concentrator from the Kennedy Creek mine comprised the lode production from the Nine Mile district in 1943.

Wallace district.—Crude copper ore and lead ore were shipped direct to smelters from the Hidden Treasure mine in 1943.

PARK COUNTY

New World district.—The concentrating mill of the McLaren Gold Mines Co. was destroyed by fire in October 1942. At that time mining operations were suspended, and all efforts were directed toward rebuilding the mill. By June 4, 1943, the mill building had been reconstructed, damaged machinery reconditioned or replaced, and operations resumed. The new mill has a 100-ton daily capacity. During the remainder of the year 9,732 tons of gold ore were milled, making 339 tons of copper concentrates containing 101,250 pounds of copper, 2,088 ounces of silver, and 1,289 ounces of gold. In 1943, the Irma mine produced a total of 258 tons of lead ore from the mine and dump, which was shipped crude to a smelter; in addition, 500 tons of zinc-lead ore were treated in the Irma mill.

POWELL COUNTY

Big Blackfoot district.—Some gold ore was shipped direct to the East Helena smelter from the Marcum Hill mine in 1943.

Nigger Hill district.—Hopkins & Sons Mining Co. operated its Charter Oak mine and 50-ton flotation plant throughout 1943. A total of 2,208 tons of zinc-lead ore was treated, making 90 tons of lead concentrates and 31 tons of zinc concentrates; the average mill heads in 1943 contained about 0.04 ounce of gold and 3.5 ounces of silver to the ton, 3.0 percent lead, and 2.5 percent zinc. Newman Bros., operating the Lilly group, the only other producer in the district in 1943, shipped 10 tons of crude lead ore to East Helena and 41 tons of zinc-lead ore to the Midvale (Utah) concentrator.

Ophir Gulch district.—A test lot of crude copper ore was shipped direct to the Washoe Sampling Works at Anaconda from the Cyclone mine in 1943.

Zozell district.—The Hidden Hand Mining Co. operated its Hidden Hand group from January to May and shipped 69 tons of siliceous ore direct to smelters.

RAVALLI COUNTY

Curlew district.—C. A. Tout, lessee, operated the Curlew mine and its 70-ton flotation concentrator throughout 1943; 1,017 tons of gold-silver-copper-lead-zinc mill ore were treated, making 51 tons of lead-copper concentrates, 13 tons of copper concentrates, and 22 tons of zinc concentrates. The ore milled in 1943 averaged 0.06 ounce of gold and 1.30 ounces of silver to the ton, 0.74 percent copper, 1.17 percent lead, and 1.60 percent zinc. In addition, 94 tons of gold-silver ore were shipped direct to a smelter.

SANDERS COUNTY

Camas Prairie district.—Copper ore shipped direct to the Washoe Sampling Works at Anaconda in 1943 from the Glaucus mine was the only production from the Camas Prairie district.

Eagle district.—All the ore mined in 1943 from the Jack Waite mine, which extends over the county line into Idaho, was from that portion within Montana. The mine was operated throughout the year by the American Smelting & Refining Co. and produced 18,727 tons of zinc-lead ore containing 16,292 ounces of silver, 3,131,154 pounds of lead, and 764,062 pounds of zinc; the grade of the ore mined was virtually the same as in 1942. The ore was milled in the company-owned 300-ton flotation mill at Duthie, Idaho; the concen trates produced amounted to 1,902 tons of lead concentrates and 581 tons of zinc concentrates. The coarse mill ore is fed to a jaw crusher for primary breaking and then passed over a 1¼-inch vibrator screen, the oversize ore going on to a sorting belt where the high-grade ore is removed. The high-grade lead ore is shipped direct to a smelter, and the rejected portion is milled. The crude ore shipped in 1943 amounted to 218 tons and contained 1,289 ounces of silver and 335,527 pounds of lead.

SILVER BOW COUNTY

The output of all five metals from mines in Silver Bow County decreased in 1943, compared with 1942. Although the Anaconda Copper Mining Co.—only active major producer in the county in 1943—treated a greater quantity of copper material than in 1942, the average content in gold, silver, and copper was less. The increase in tonnage with decrease in content was due to the treatment of a greater proportion of mine dumps and waste tailings in 1943. The only zinc ore produced on company accounts, aside from the zinc-lead middlings product made from the treatment of manganese ore, was in the course of development or exploration in the company zinc mines. The following table gives the output of mines in Silver Bow County (which includes the Butte or Summit Valley district) in 1942 and 1943 and the total from 1882 to the end of 1943.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1942–43, and total, 1882–1943, in terms of recovered metals

Year	Mines producing	Ore (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1942	38	4,753,741	22,381	8,123,788	280,698,000	14,411,000	58,626,000	$46,942,464
1943	28	5,163,966	16,132	6,487,380	267,137,700	6,579,400	15,754,000	42,100,656
1882–1943		(1)	1,991,324	532,388,405	[2] 6,280,598	[2] 226,232	[2] 1,547,081	2,507,150,259

[1] Figures not available.
[2] Short tons.

Butte or Summit Valley district.—The following operating details are taken in part from the Anaconda Copper Mining Co. printed annual report for the year ended December 31, 1943.

Copper production at the copper mines at Butte was maintained in 1943 at levels comparable with 1942, notwithstanding an acute manpower shortage. This shortage was relieved somewhat by the furloughing of soldiers by the United States Army and by a "miners training program" that prepared inexperienced men for underground work. Most of the planned improvements begun in 1942 were completed and aided materially in increasing production and offsetting increased costs. Facilities were installed at Anaconda for the treatment of waste production accumulated from previous operations which will add approximately 25,000,000 pounds of copper per year to production. During 1943 the aggregate tonnage of copper ore, dumps, waste tailings, and slimes treated exceeded that in 1942 by 16 percent. The copper concentrator at Anaconda treated 3,197,206 tons of copper ore from company-owned Butte mines, compared with

3,287,817 tons in 1942; and 3,582 tons of copper mine-water precipitates were treated, compared with 4,589 tons in 1942. In addition, the copper concentrator at Anaconda treated 812,513 tons of New Works sand tailings (averaging about 0.6 percent copper), compared with none in 1942; 404,359 tons of mine dumps (averaging about 0.6 percent copper), compared with 241,526 tons in 1942; 372,049 tons of Old Works tailings (averaging about 1.25 percent copper), compared with 727,464 tons in 1942; and 88,314 tons of special waste, compared with none in 1942. Crude ore from the Butte mines amounted to 79,613 tons; Old Works tailings, Butte and Boston slime, and New Works tailings totaled 44,689 tons.

A slime-disintegrating plant about 2½ miles east of Anaconda was built in 1943. The plant has a 1,500-ton daily capacity and is to treat the slime deposits east of Anaconda. Briefly, the treatment process is as follows: Slime is excavated from the ponds by dragline, carried by trucks to the "wash mills," and water is added. The "wash mills" are concrete tanks, with vertical shafts, and arms dragging harrows. The slime is converted into pulp, and the pulp is screened and pumped into two Hardinge mills, where sand contained in the pulp is ground to flotation size. The pulp is then treated in flotation machines for recovery of copper sulfide; the concentrate is dewatered and taken by conveyor belt to the smelter. During 1943 the plant treated 13,816 tons of slimes that averaged over 2 percent copper; flotation copper concentrate and table iron concentrates were made.

The North Butte Mining Co. property was operated throughout 1943 by the Anaconda Copper Mining Co. under contract agreement. The output from the property in 1943 amounted to 100,368 tons of copper mill ore and 176 tons of copper mine-water precipitates. Incidental to exploration and development in the zinc mines, a total of 10,854 tons of zinc-lead ore was removed. Development at all company copper mines comprised 241,197 feet of drifts, 535 feet of shafts, and 5,790 feet of diamond drilling; and at all zinc mines 7,624 feet of drifts and 1,888 feet of diamond drilling. The Anaconda Copper Mining Co. operated the Emma mine throughout 1943 under lease from the Butte Copper & Zinc Co. Production amounted to 25,962 tons of zinc-lead middlings (from the treatment of manganese ore); in addition, 1,696 tons of zinc-lead middlings were produced as a byproduct of the milling of manganese ore from the Orphan Girl and Travona mines; all were treated in the Anaconda zinc concentrator. Development comprised 23,095 feet of drifts and 857 feet of diamond drilling on the Emma mine and 7,426 feet of drifts and 924 feet of diamond drilling on company-owned manganese mines.

Lessees of the Anaconda Copper Mining Co. operated several company properties; the most productive were the Poulin, which yielded zinc-lead ore containing about 2,600,000 pounds of zinc and 700,000 pounds of lead; and the Black Rock group, which yielded 1,442 tons of silver ore and 102 tons of zinc ore. Lessee operations were smaller in 1943 than in 1942.

Highland district.—A lessee shipped 229 tons of gold ore direct to smelters from the Butte Highlands property in 1943.

Melrose district.—A car of silver ore from the Lincoln mine was shipped direct to the Washoe Sampling Works at Anaconda in 1943.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA

(MINE REPORT)

By Charles White Merrill

SUMMARY OUTLINE

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SUMMARY

The total value of gold, silver, copper, lead, and zinc recovered from ore, old tailings, and gravels in Nevada decreased 21 percent in 1943 compared with 1942; all five metals except zinc decreased in both quantity and value. The value of the zinc output was the largest since 1916. Higher wages, enlistment of miners in the armed forces, migration of miners to war industries and military construction jobs, rising prices of supplies and equipment and difficulties in obtaining them, increased taxes, and fixed prices for gold and silver were factors in reducing the total output, despite Nevada's great mineral resources and the war demand on many of them. The continued enforcement of War Production Board Order L–208 of October 8, 1942, was also a factor in the lowered output of gold mines. During 1943, however, seven grants permitting expanded production were authorized to Nevada operators by the War Production Board.

Comparing 1943 with 1942, gold output decreased 51 percent and silver 56 percent in both quantity and value; copper decreased 15 percent in quantity and 9 percent in value; lead decreased 11 percent in quantity and less than 1 percent in value; and zinc increased 34 percent in quantity and 55 percent in value. Of the total value of the five metals copper comprised 65 percent, gold 18, zinc 10, silver 4, and lead 3 percent.

White Pine County increased its lead over the other counties and produced 68 percent of the State total value of the five metals; it stood first in output of copper and of gold. Lincoln County produced 13 percent of the State total value and ranked second to White Pine County; it led in the State in zinc, silver, and lead output.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of January 31, 1934. Treasury legal coinage value of gold from January 18, 1837, to January 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.
[4] $0.67878787.
[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1939–43, and total, 1859–1943, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	891	104	6, 894, 999	361, 518	$12, 653, 130	4, 316, 029	$2, 929, 668
1940	895	115	8, 338, 259	383, 933	13, 437, 655	5, 175, 928	3, 680, 660
1941	799	78	8, 799, 635	366, 403	12, 824, 105	5, 830, 238	4, 145, 947
1942	434	49	9, 383, 379	295, 112	10, 328, 920	3, 723, 435	2, 647, 776
1943	168	17	8, 364, 043	144, 442	5, 055, 470	1, 620, 280	1, 152, 199
1859–1943 [2]			([3])	25, 215, 000	561, 086, 676	586, 050, 045	538, 078, 376

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	133, 194, 000	$13, 852, 176	8, 472, 000	$398, 184	12, 456, 000	$647, 712	$30, 480, 870
1940	156, 908, 000	17, 730, 604	14, 998, 000	749, 900	23, 666, 000	1, 490, 958	37, 089, 777
1941	157, 822, 000	18, 622, 996	19, 246, 000	1, 097, 022	30, 258, 000	2, 269, 350	38, 959, 420
1942	167, 326, 000	20, 246, 446	10, 752, 000	720, 384	20, 394, 000	1, 896, 642	35, 840, 168
1943	142, 136, 000	18, 477, 680	9, 580, 000	718, 500	27, 294, 000	2, 947, 752	28, 351, 601
1859–1943 [2]	[4] 1, 620, 225	459, 218, 648	[4] 527, 125	56, 547, 267	[4] 282, 683	40, 307, 678	1, 655, 238, 645

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Compiled by Chas. W. Henderson, chief, Western Offices Section, Metal Economics Division, Denver, Colo. From 1904 (when first satisfactory annual canvass of mine production was made) to 1943, inclusive, the output was as follows: Gold, 13,388,123.51 ounces valued at $316,603,443; silver, 297,637,196 ounces, $200,920,153; copper, 1,618,299 short tons, $458,572,020; lead, 289,334 tons, $33,910 705; zinc, 282,683 tons, $40,307,678; total value, $1,050,313,999.
[3] Figures not available.
[4] Short tons.

Gold.—Gold production in Nevada in 1943 was the lowest in quantity and value since 1934. Although the recession in gold began after the large output of 1940, monthly production did not assume a marked downward trend until August 1942. By February 1943 a much lower level had been established, which persisted with minor fluctuations throughout the remainder of the year. This period of sharp decline included the weeks when War Production Board Limitation Order L–208, promulgated October 8, 1942, was taking effect.

The 10 leading gold-producing mines in 1943 supplied 93 percent of Nevada's output, and the 3 leaders contributed 69 percent. The importance of base-metal mines where gold is a byproduct is significant; 1943 was the first year in the history of the State when more gold was derived from base-metal ores than from dry ores.

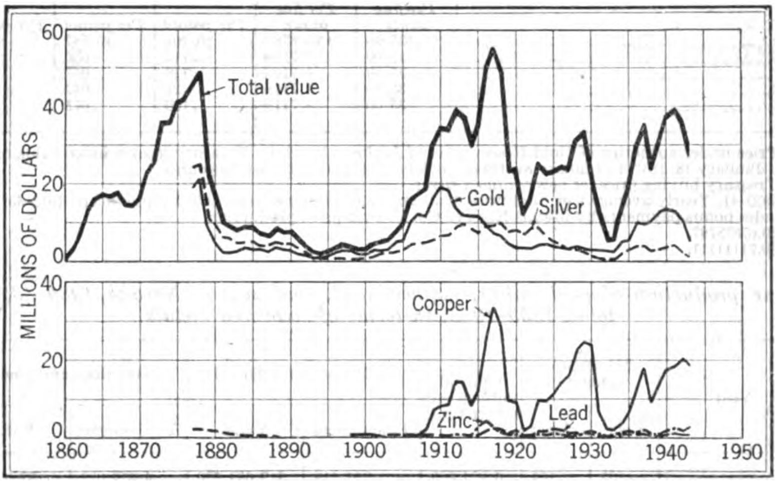

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Nevada, 1860–1943.

Ten leading gold-producing mines in Nevada in 1943, in order of output

Rank	Mine	District	County	Rank in 1942	Operator	Source of gold
1	Ruth and Copper Flat Pit.	Robinson	White Pine	2	Kennecott Copper Corporation (Nevada Mines Division).	Copper ore.
2	Getchell	Potosi	Humboldt	1	Getchell Mine, Inc	Gold ore.
3	Coppermines group	Robinson	White Pine	3	Consolidated Coppermines Corporation.	Copper ore.
4	Manhattan dredge	Manhattan	Nye	4	Manhattan Gold Dredging Co.	Dredge.
5	Copper Canyon	Battle Mountain.	Lander	12	International Smelting & Refining Co.	Copper ore.
6	Goldacres	Bullion	do	6	Willow Creek Mines, Inc.	Gold ore.
7	Crown Point and Yellow Jacket.	Comstock	Storey	13	Sutro Tunnel Coalition, Inc.	Gold-silver ore.
8	Overman	do	do	7	Consolidated Chollar Gould & Savage Mining Co.	Gold ore and old tailings.
9	Mary	Silver Peak	Esmeralda	11	Fred Vollmar and Carson Frazzini.	Gold ore.
10	Mizpah	Tonopah	Nye	18	Various lessees	Gold-silver ore

Silver.—The 10 leading silver-producing mines in Nevada in 1943, listed in the following table, produced 79 percent of the State total recoverable silver; the first 2 yielded over one-fourth of the total. As in preceding years, most of the silver was a byproduct of ore mined chiefly for other metals; only 21 percent of it was derived from straight silver ore. The Nivloc mine, the State's leading silver mine from 1938 to 1942, dropped to second place in 1943; production was suspended during the year, and mine and mill equipment was sold.

Ten leading silver-producing mines in Nevada in 1943, in order of output

Rank	Mine	District	County	Rank in 1942	Operator	Source of silver
1	Pioche Nos. 1 and 2 group.	Pioche	Lincoln	4	Combined Metals Reduction Co.	Zinc ore and gold-silver old tailings.
2	Nivloc	Silver Peak	Esmeralda	1	Desert Silver, Inc.	Silver ore.
3	Ruth and Copper Flat Pit.	Robinson	White Pine	8	Kennecott Copper Corporation (Nevada Mines Division).	Copper ore.
4	Mizpah	Tonopah	Nye	2	Various lessees	Gold-silver ore.
5	Bristol Silver	Jack Rabbit	Lincoln	3	Bristol Silver Mines Co.	Silver ore.
6	Crown Point and Yellow Jacket.	Comstock	Storey	11	Sutro Tunnel Coalition, Inc.	Gold-silver ore
7	Copper Canyon	Battle Mountain.	Lander	17	International Smelting & Refining Co.	Copper ore.
8	Financier	Pioche	Lincoln	6	Salt Lake-Pioche Mining Co.	Lead ore.
9	Rip Van Winkle	Merrimac	Elko	5	Rip Van Winkle Consolidated Mining Co.	Do.
10	Prince	Pioche	Lincoln	14	Prince Consolidated Mining Co.	Lead ore and zinc ore.

Copper.—Over 97 percent of the recoverable copper output of Nevada in 1943 came from mines operated by the following companies: The Kennecott Copper Corporation (Nevada Mines Division), working the Ruth mine at Ruth and the open pit at Copper Flat (both in the Robinson district, White Pine County); the Consolidated Coppermines Corporation, working the Coppermines group at Kimberly (also in the Robinson district); and the Mountain City Copper Co., working the Mountain City mine at Mountain City (in the Cope district, Elko County). Late in 1943 the Consolidated Coppermines Corporation began production from a newly opened open pit at Kimberly, which it named Tonopah Pit.

Lead.—Over 61 percent of the lead produced in Nevada in 1943 was mined in the Pioche district, Lincoln County, where the leading properties were: The Pioche Nos. 1 and 2 group operated by the Combined Metals Reduction Co., the Financier mine operated by the Salt Lake-Pioche Mining Co. and lessees, and the Prince mine operated by the Prince Consolidated Mining Co. Other important producers in the State were: The Bristol Silver Mines Co. Bristol Silver mine (in the Jack Rabbit district, Lincoln County) and the Rip Van Winkle Consolidated Mining Co. Rip Van Winkle mine (in the Merrimac district, Elko County).

Zinc.—As in recent years, zinc production in Nevada was centered in the Pioche district, Lincoln County, where 88 percent of the State total in 1943 was mined. The Combined Metals Reduction Co., Prince Consolidated Mining Co., and Ely Valley mine were the principal producers. The addition of a slag-fuming plant for recovering zinc from lead blast-furnace slag and from oxidized zinc ore at the Tooele (Utah) plant of the International Smelting & Refining Co. has offered a new market to some Nevada miners.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1943, by counties, in terms of recovered metals

County	Mines producing [1]		Gold						Silver (lode and placer)	
			Lode		Placer		Total			
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Churchill	2		66	$2, 810			66	$2, 310	1, 125	$800
Clark	10		1, 008	35, 280			1, 008	35, 280	13, 566	9, 647
Douglas	1	1			3	$105	3	105	346	246
Elko	20		366	12, 810			366	12. 810	107, 453	76, 411
Esmeralda	6		3, 245	113. 575			3, 245	113, 575	210, 725	149, 849
Eureka	8	1	208	7, 280	23	805	231	8, 085	3, 530	2, 510
Humboldt	9	1	35, 318	1, 236, 130	19	665	35, 337	1, 236, 795	12, 064	8, 579
Lander	19		16, 371	572, 985	8	280	16, 379	573, 265	116, 190	82, 624
Lincoln	14		2, 660	93, 100			2, 660	93, 100	511, 965	364, 064
Lyon	6		14	490	65	2, 275	79	2. 765	419	298
Mineral	9		122	4, 270			122	4, 270	12, 077	8, 588
Nye	19	7	2, 929	102. 515	11, 004	385, 140	13, 933	487, 655	220, 417	156, 741
Pershing	10	6	1, 105	38, 675	79	2, 765	1, 184	41, 440	21, 921	15, 588
Storey	5	1	5, 225	182, 875	28	980	5, 253	183, 855	123, 373	87, 732
Washoe	10		178	6, 230			178	6, 230	3, 420	2, 432
White Pine	20		64, 398	2, 253, 930			64, 398	2, 253, 930	261, 689	186. 090
	168	17	133. 213	4, 662, 455	11, 229	393, 015	144, 442	5, 055, 470	1, 620, 280	1, 152, 199
Total, 1942	434	49	247. 758	8, 671, 530	47, 354	1. 657, 390	295, 112	10, 328, 920	3, 723, 435	2, 647, 776

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill							$3. 110
Clark	4, 000	$520	54, 000	$4, 050	60, 000	$6. 480	55, 977
Douglas			8, 000	600			951
Elko	10, 460, 000	1, 359, 800	1, 000. 000	75, 000	530, 000	57, 240	1, 581. 261
Esmeralda	2, 000	260	4, 000	300			263, 984
Eureka			14, 000	1. 050	80. 000	8, 640	20, 285
Humboldt	64, 000	8, 320	6, 000	450			1, 254, 144
Lander	1, 968, 000	255, 840	96, 000	7. 200	8, 000	864	919. 793
Lincoln	542, 000	70, 460	6, 922, 000	519, 150	24, 172, 000	2, 610, 576	3, 657, 350
Lyon	220, 000	28, 600					31, 663
Mineral	6. 000	780	126, 000	9, 450	76, 000	8, 208	31, 296
Nye	2. 000	260	598, 000	44, 850	60. 000	6, 480	695, 986
Pershing	634, 000	82, 420	134, 000	10, 050	64, 000	6, 912	156, 410
Storey							271. 587
Washoe	10, 000	1, 300	38, 000	2, 850	606, 000	65, 448	78. 260
White Pine	128, 224, 000	16. 669, 120	580, 000	43, 500	1, 638, 000	176, 904	19, 329. 544
	142, 136, 000	18, 477, 680	9, 580. 000	718, 500	27, 294, 000	2, 947, 752	28, 351, 601
Total, 1942	167, 326, 000	20. 246. 446	10, 752, 000	720, 384	20, 394, 000	1. 896, 642	35, 840, 168

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

MINING INDUSTRY

The 11-percent decline in total tonnage of ore and old tailings sold or treated in Nevada in 1943, compared with 1942, resulted principally from suspension of operations at mines where dry and siliceous ore was produced. In addition, there was a small recession in production of copper ore due mainly to chronic labor shortage throughout the State.

The connected-bucket dredge of the Manhattan Gold Dredging Co. in the Manhattan district, Nye County, was again the largest producer of placer gold and again the fourth-largest of total gold in the State. Except for this operation, Nevada placer mines were virtually quiescent.

ORE CLASSIFICATION

The following table classifying ores produced in Nevada in 1943 shows that 92 percent of the tonnage (including old tailings) sold or treated was copper ore, 5 percent gold ore and old tailings, 2 percent zinc ore, and the remainder gold-silver ore and old tailings, silver ore, lead ore and old tailings, and zinc-lead ore.

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Nevada in 1943, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	354, 400	22, 622	50, 960	53, 386	70, 100	14, 000	....
Dry and siliceous gold-silver ore	47, 303	3, 990	5, 746	295, 273	22. 800	31. 900	....
Dry and siliceous silver ore	33, 860	....	1, 028	333. 051	533, 500	917. 300	183. 300
	435, 563	26, 612	57, 734	681. 710	626, 400	963, 200	183, 300
Copper ore	7, 721, 562	....	72, 449	365, 112	[1]141. 443, 700	9, 300	....
Lead ore	22, 177	120	1, 053	293. 724	51, 600	3, 499, 200	506, 300
Zinc ore	156, 845	....	1, 904	264, 860	11, 700	4, 928, 300	26, 365, 500
Zinc-lead ore	1, 164	....	73	10, 440	2, 600	180. 000	238, 900
Total, lode mines	8, 337, 311	26, 732	133, 213	1, 615, 846	[1]142, 136, 000	9, 580, 000	27, 294, 000
Total, placers	....	....	11, 229	4, 434	....	....	....
	8, 337, 311	26, 732	144, 442	1, 620, 280	[1]142, 136, 000	9, 580. 000	27, 294, 000
Total, 1942	9, 295, 538	87, 841	295, 112	3, 723, 435	[2]167, 326, 000	10, 752, 000	20, 394, 000

[1] Includes 8,865,300 pounds of copper from precipitates.
[2] Includes 6,172,600 pounds of copper from precipitates.

METALLURGIC INDUSTRY

Of the 8,364,043 tons of lode material from Nevada mines sold or treated during 1943, 93 percent went to concentrating mills, 5 percent to amalgamation and cyanidation mills, and 2 percent to smelters; of this material, 0.32 percent was old tailings—all amalgamated, cyanided, or smelted. Flotation was employed at concentration mills to the virtual exclusion of gravity concentration. Of the gold recovered as bullion, cyanidation supplied 96 percent and amalgamation 4 percent; of the silver recovered as bullion, 99.5 percent was derived by cyanidation and 0.5 percent by amalgamation. The tonnage of crude ore and old tailings shipped to smelters increased 1 percent in 1943 compared with 1942.

The 175-ton all-slime cyanide mill at the Nivloc mine, Silver Peak district, Esmeralda County, was dismantled during 1943.

The 500-ton selective-flotation mill, operated by the Combined Metals Reduction Co. at Pioche, Lincoln County, treated zinc-lead and zinc ores upon a custom basis for several neighboring mines and also milled company zinc-lead ore. The Kennecott Copper Corporation treated all the copper ore produced by the Consolidated Coppermines Corporation upon a contract basis, in addition to milling its own ore. The Kennecott Copper Corporation also operated the McGill copper smelter, which was Nevada's only smelter and the most important privately financed metallurgical plant in the State.

Mine production of metals in Nevada in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	1,521	2,253	1,631	--------	--------	--------
Ore, old tailings, sands, and slimes cyanided	419,122	48,033	332,554	--------	--------	--------
Concentrates smelted:						
Flotation	284,193	75,006	714,591	124,269,800	5,838,900	25,300,100
Gravity	32	54	740	--------	5,500	--------
Ore and old tailings smelted	144,713	7,867	566,330	9,000,900	3,735,600	1,993,900
Precipitates smelted	--------	--------	--------	8,865,300	--------	--------
Total, lode mines	--------	133,213	1,615,846	142,136,000	9,580,000	27,294,000
Total, placers	--------	11,229	4,434	--------	--------	--------
	--------	144,442	1,620,280	142,136,000	9,580,000	27,294,000
Total, 1942	--------	295,112	3,723,435	167,326,000	10,752,000	20,394,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Nevada in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal					
	Ore[1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Humboldt	656	--------	262	263	--------	--------	--------	--------	--------	--------
Lander	100	--------	45	7	--------	--------	--------	--------	--------	--------
Lyon	10	--------	5	4	--------	--------	--------	--------	--------	--------
Nye	358	--------	829	496	--------	--------	--------	--------	--------	--------
Pershing	266	--------	942	776	--------	--------	--------	--------	--------	--------
Storey	4	50	7	14	--------	--------	--------	--------	--------	--------
Washoe	77	--------	163	71	--------	--------	--------	--------	--------	--------
	1,471	50	2,253	1,631	--------	--------	--------	--------	--------	--------
Total, 1942	88,308	1,549	8,521	7,239	297	2,886	29,426	--------	200	--------
CYANIDATION MILLS										
Esmeralda	20,983	--------	903	207,523	--------	--------	--------	--------	--------	--------
Humboldt	257,572	--------	34,379	4,461	480	668	6,142	64,000	5,700	--------
Lander	48,726	--------	7,798	664	--------	--------	--------	--------	--------	--------
Storey	69,269	22,572	4,953	119,906	--------	--------	--------	--------	--------	--------
	396,550	22,572	48,033	332,554	480	668	6,142	64,000	5,700	--------
Total, 1942	1,086,209	81,035	134,064	1,506,409	98	680	8,771	1,700	10,700	3,900
Grand total:										
1943	398,021	22,622	50,286	334,185	480	668	6,142	64,000	5,700	--------
1942	1,174,517	82,584	142,585	1,513,648	395	3,566	38,197	1,700	10,900	3,900

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[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.

Mine production of metals from concentrating mills in Nevada in 1943, in terms of recovered metals

BY COUNTIES

	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	7,764	82	628	10,828			
Elko	108,862	22,002	226	87,809	8,170,900	649,400	500,000
Lander	99,582	10,480	7,928	85,772	1,716,600		
Lincoln	149,668	29,283	1,888	262,489	2,700	4,916,300	23,982,100
Mineral	940	271	12	4,389	6,000	94,800	76,000
Nye	537	248	54	8,641		91,800	60,000
Pershing	593	103	57	1,666	1,300	7,400	63,600
Storey	5,000	129	265	3,373			
Washoe	3,899	710	10	3,307	7,600	38,000	606,000
White Pine	7,421,842	220,437	63,324	240,915	114,300,700	41,000	12,400
	7,798,687	283,745	74,392	709,189	124,205,800	5,838,700	25,300,100
Total, 1942	8,007,455	327,665	80,395	917,861	153,650,600	6,008,400	18,753,200

BY CLASSES OF CONCENTRATES

Dry gold	129	265	3,373			
Dry gold-silver	353	659	13,433	2,400	21,100	
Dry silver	50		69	500	3,700	
Copper	251,777	71,467	339,618	124,176,000		
Lead	7,002	1,262	241,262	9,700	5,208,500	545,700
Lead-copper	30	4	2,273	3,400	31,300	
Zinc	24,325	725	107,770	12,800	562,900	24,682,000
Zinc-lead	79	10	1,391	1,000	11,200	72,400
	283,745	74,392	709,189	124,205,800	5,838,700	25,300,100

Gross metal content of concentrates produced from ores mined in Nevada in 1943, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	609	933	9,515	66,026	7,923	
Dry gold-silver	353	659	13,433	3,292	23,161	74,970
Dry silver	50		69	659	4,232	1,399
Copper	251,777	71,467	339,618	124,970,670		
Lead	7,002	1,262	241,262	13,042	5,313,722	909,165
Lead-copper	30	4	2,273	5,135	32,513	69,900
Zinc	24,325	725	107,770	16,049	622,229	27,474,733
Zinc-lead	79	10	1,391	1,078	12,267	82,979
	284,225	75,060	715,331	125,075,951	6,016,047	28,613,146
Total, 1942	328,060	83,961	956,058	155,947,809	6,295,955	21,112,406

Mine production of metals from Nevada concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	82	628	10,828	----------	----------	----------
Elko	22,002	226	87,809	8,170,900	649,400	500,000
Humboldt	480	668	6,142	64,000	5,700	----------
Lander	10,480	7,928	85,772	1,716,600	----------	----------
Lincoln	29,283	1,888	262,489	2,700	4,916,300	23,982,100
Mineral	271	12	4,389	6,000	94,800	76,000
Nye	248	54	8,641	----------	91,800	60,000
Pershing	103	57	1,666	1,300	7,400	63,600
Storey	129	265	3,373	----------	----------	----------
Washoe	710	10	3,307	7,600	38,000	606,000
White Pine	220,437	63,324	240,915	114,300,700	41,000	12,400
	284,225	75,060	715,331	124,269,800	5,844,400	25,300,100
Total, 1942	328,060	83,961	956,058	153,652,800	6,019,300	18,757,100

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	609	933	9,515	64,000	5,700	----------
Dry gold-silver	353	659	13,433	2,400	21,100	----------
Dry silver	50	----------	69	500	3,700	----------
Copper	251,777	71,467	339,618	124,176,000	----------	----------
Lead	7,002	1,262	241,262	9,700	5,208,500	545,700
Lead-copper	30	4	2,273	3,400	31,300	----------
Zinc	24,325	725	107,770	12,800	562,900	24,682,000
Zinc-lead	79	10	1,391	1,000	11,200	72,400
	284,225	75,060	715,331	124,269,800	5,844,400	25,300,100

Gross metal content of Nevada crude ore and old tailings shipped to smelters in 1943, by classes of material

Class of material	Material shipped		Gross metal content				
	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	3,862	--------	3,458	8,382	8,103	15,112	----------
Dry and siliceous gold-silver	7,539	3,990	2,250	192,532	24,331	45,053	----------
Dry and siliceous silver	12,877	--------	125	125,528	628,124	994,477	286,791
Copper	97,984	--------	982	25,494	[1] 17,426,630	15,032	----------
Lead	14,045	120	1,030	212,695	51,192	2,693,465	225,540
Zinc	3,691	--------	3	55	16,078	120,861	2,111,705
Zinc-lead	605	--------	19	1,644	3,259	92,596	256,326
	140,603	4,110	7,867	566,330	[1] 18,157,717	3,976,596	2,880,362
Total, 1942	136,276	6,756	21,212	1,233,749	[2] 14,039,484	5,234,198	2,131,117

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[1] Includes 8,883,927 pounds of copper contained in precipitates.

[2] Includes 6,236,762 pounds of copper contained in precipitates.

Mine production of metals from Nevada crude ore and old tailings shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Material shipped		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	63	--------	66	1,125	------------	------------	----------
Clark	742	--------	380	2,738	4,000	54,000	60,000
Douglas	35	--------	--------	346	------------	8,000	----------
Elko	8,623	--------	140	19,644	2,289,100	350,600	30,000
Esmeralda	2,619	--------	2,342	3,202	2,000	4,000	----------
Eureka	453	--------	208	3,527	------------	14,000	80,000
Humboldt	12	--------	9	1,194	------------	300	----------
Lander	3,948	--------	600	29,747	251,400	96,000	8,000
Lincoln	17,946	3,990	772	249,476	539,300	2,005,700	189,900
Lyon	2,525	--------	9	356	220,000	------------	----------
Mineral	197	--------	110	7,688	------------	31,200	----------
Nye	8,389	120	2,046	207,012	2,000	506,200	----------
Pershing	7,682	--------	106	19,459	632,700	126,600	400
Washoe	53	--------	5	42	2,400	------------	----------
White Pine	87,316	--------	1,074	20,774	[1] 13,923,300	539,000	1,625,600
	140,603	4,110	7,867	566,330	[1] 17,866,200	3,735,600	1,993,900
Total, 1942	136,276	6,756	21,212	1,233,749	[2] 13,673,700	4,732,700	1,636,900

BY CLASSES OF MATERIAL

	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	3,862	--------	3,458	8,382	6,100	8,300	----------
Dry and siliceous gold-silver	7,539	3,990	2,250	192,532	22,800	26,400	----------
Dry and siliceous silver	12,877	--------	125	126,528	533,500	917,300	183,300
Copper	97,984	--------	982	25,494	[1] 17,267,700	9,300	----------
Lead	14,045	120	1,030	212,695	33,400	2,589,700	25,600
Zinc	3,691	--------	3	55	100	99,800	1,609,100
Zinc-lead	605	--------	19	1,644	2,600	84,800	175,900
	140,603	4,110	7,867	566,330	[1] 17,866,200	3,735,600	1,993,900

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[1] Includes 8,865,300 pounds of copper from precipitates.

[2] Includes 6,172,600 pounds of copper from precipitates.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1943, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
Churchill County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Eastgate	1		60	66		66	491				$2,659
Holy Cross	1		3				634				451
Clark County:											
Eldorado Canyon	4		8,237	869		869	11,963	1,000			39,052
Searchlight	2		117	139		139	1,454	3,000	4,100		6,596
Yellow Pine	4		152				149		49,900	60,000	10,329
Douglas County:											
Mountain House	1		35				346		8,000		846
Mount Siegel		1			3	3					105
Elko County:											
Alabama	1		38	2		2	86	4,100			664
Contact	4		1,240	17		17	1,762	111,200			16,304
Delano	2		356				5,936	200	72,800		9,707
Gold Circle	1		12	51		51	578				2,196
Jarbidge	1		1	12		12	28				440
Merrimac	1		5,530	11		11	74,153	9,500	627,200	392,300	143,759
Railroad	4		1,030	3		3	2,080	10,900	147,300	3,000	14,373
Ruby Valley	1		861				139		18,800	104,700	2,817
Spruce Mountain	1		872	8		8	6,307	1,100	62,700		9,610
Tecoma	1		261	4		4	1,025	400	71,200		6,261
Warm Creek	1		105							30,000	3,240
Esmeralda County:											
Divide	1		531	379		379	1,371				14,240
Goldfield	2		143	122		122	284	1,700	3,600		4,963
Silver Peak	3		22,928	2,744		2,744	209,070	300	400		244,781
Eureka County:											
Cortez	1		79	84		84	48				2,974
Eureka	7		374	124		124	3,479		14,000	80,000	16,504
Lynn		1			23	23	3				807
Humboldt County:											
Awakening	3		477	161		161	90				5,699
Barrett Springs	3		178	92		92	35				3,245
Gold Run	1	1	12	9	19	28	1,198		300		1,854
National	1		1	9		9	138				413
Potosi	1		257,572	35,047		35,047	10,603	64,000	5,700		1,242,933

Lander County:											
Battle Mountain	12	(4)	103,449	8,284	8	8,292	114,705	1,967,900	91,800	8,000	$635,364
Bullion	4		48,789	7,936		7,936	1,125		4,000		278,860
Hilltop	1		16	106		106	187	100	200		3,871
New Pass	1		100	45		45	7				1,580
Reese River	1		2				166				118
Lincoln County:											
Eagle Valley	1		3	7		7	49				280
Freiberg	1		105	250		250	651		6,800	7,600	10,544
Groom	1		1,560				2,828		203,500		17,273
Jack Rabbit	1		10,863	42		42	98,474	530,400	817,600	182,300	221,456
Pahranagat	1		80	1		1	1,242	900	9,900		1,778
Pioche	9		158,993	2,360		2,360	408,721	10,700	5,884,200	23,982,100	3,406,019
Lyon County:											
Silver City	1	(4)	10	5	65	70	63				2,495
Yerington	5		2,525	9		9	356	220,000			29,168
Mineral County:											
Bell	1		940	12		12	4,389	6,000	94,800	76,000	19,639
Columbus	1		55	35		35	1,001		9,400		2,642
Garfield	1		40	45		45	6,276		9,300		6,736
Hawthorne	3		39	1		1	45		8,100		674
Marietta	1		2				86		1,800		196
Regent	1		40	26		26	62		300		976
Silver Star	1		21	8		8	218		2,300		433
Nye County:											
Bullfrog	2		104	54		54	567				2,293
Johnnie		1			10	10					350
Manhattan	7	5	387	829	10,948	11,777	4,933		5,800		416,138
Quartz Mountain	1		269	25		25	3,510	1,100	58,600		7,909
San Antone	1		1	6		6	450				530
Tonopah	3		5,128	1,709		1,709	159,141	500	500		173,084
Tybo	4		3,505	306		306	50,210	400	528,800	60,000	92,607
Union	1		15				1,582		4,300		1,448
Pershing County:											
Antelope	1	(4)	7,302	70	3	73	11,080	625,000			91,684
Goldbanks	1		32				38	2,500			352
Imlay		1			3	3					105
Jersey	1		101	4		4	2,392	200	34,900	400	4,528
Rochester	1	3	323	34	16	50	6,850	5,400	93,600	63,600	21,212
Rosebud		(4)			25	25	3				877
Seven Troughs	3		261	927		927	769				32,992
Unionville	1	1	17	1	3	4	28	900			277
Willow Creek		1			29	29	14				1,025

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1943, by counties and districts, in terms of recovered metals[1]—Continued

County and district[1]	Mines producing[2]		Ore and old tailings	Gold			Silver (lode and placer)[3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Storey County: Comstock	5	1	96,895	5,225	28	5,253	123,373	----------	----------	----------	$271,68
Washoe County:											
Peavine	2	----------	53	5	----------	5	42	2,400	----------	----------	517
White Horse	6	----------	76	162	----------	162	65	----------	----------	----------	5,716
White Pine County:											
Aurum	1	----------	1,795	3	----------	3	2,226	30,900	24,600	499,000	61,442
Cherry Creek	2	----------	399	34	----------	34	2,146	----------	----------	----------	2,716
Granite	1	----------	11	33	----------	33	7	----------	----------	----------	1,160
Kinsley	1	----------	30	----------	----------	----------	454	600	3,800	----------	686
Robinson	14	----------	7,505,515	64,323	----------	64,323	254,046	[5] 128,179,900	315,800	1,126,600	19,240,706
White Pine	1	----------	1,408	5	----------	5	2,810	12,600	235,800	12,400	22,835
Other districts[6]	6	1	111,584	338	46	384	19,443	10,330,200	43,500	606,000	1,438,902
Total Nevada	168	17	8,364,043	133,213	11,229	144,442	1,620,280	[5] 142,136,000	9,580,000	27,294,000	28,351,601

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[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 6 and their output included under "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 1,615,846 ounces from lode mines and 4,434 ounces from placers.

[4] Output from property not classed as a "mine."

[5] Includes 8,865,300 pounds of copper from precipitates.

[6] Includes following districts: Cope and Dolly Varden in Elko County; Round Mountain in Nye County; Sierra and Staggs in Pershing County; and Galena in Washoe County.

CLARK COUNTY

Eldorado Canyon district.—W. W. Hartman operated the Wall Street mine from January 1 to June 18, 1943; 7,764 tons of gold-silver ore treated in the company 60-ton flotation mill yielded 82 tons of gold-silver concentrates (containing 628 ounces of gold and 10,828 ounces of silver), which were shipped to a smelter.

Searchlight district.—A lessee shipped 37 tons of ore, containing 110 ounces of gold and 1,077 ounces of silver, produced at the Blossom mine during 1943.

Yellow Pine (Goodsprings) district.—The Root Zinc Mining Co. worked the Root Zinc mine throughout 1943; 115 tons of zinc-lead ore shipped to a smelter contained 22,469 pounds of lead and 74,906 pounds of zinc. In addition, the company shipped a larger tonnage of ore to the Metals Reserve Co. stock pile at Jean. H. C. Kennedy worked the Whale mine during 1943; 20 tons of lead ore shipped to a smelter contained 104 ounces of silver and 17,824 pounds of lead. In addition, 69 tons of ore containing 43,760 pounds of zinc were shipped to the Metals Reserve Co. stock pile at Jean.

ELKO COUNTY

Contact (Salmon River) district.—The Marshall Mining Co. operated the Delano and Allen mines as a unit throughout 1943; 1,181 tons of copper ore containing 15 ounces of gold, 1,642 ounces of silver, and 107,762 pounds of copper were shipped to a smelter.

Cope (Mountain City) district.—The Mountain City Copper Co. (third-largest copper producer in Nevada) was active throughout 1943; part of the ore was treated in the company 400-ton flotation mill, and high-grade copper ore was shipped for direct smelting.

Dolly Varden district.—The International Smelting & Refining Co. carried on development at the Victoria mine throughout 1943, and the copper ore produced was shipped to a smelter. Much of the work was done by Negro miners released from the Army for jobs in western metal mines; as far as is known this represents the first employment of Negroes underground in the State of Nevada.

Merrimac district.—The Rip Van Winkle Consolidated Mining Co. worked the Rip Van Winkle mine throughout 1943; 5,530 tons of lead ore treated in the company 100-ton flotation mill yielded 455 tons of lead concentrate (containing 9 ounces of gold, 72,115 ounces of silver, 6,728 pounds of copper, 647,062 pounds of lead, and 21,110 pounds of zinc) and 450 tons of zinc concentrate (containing 2 ounces of gold, 2,038 ounces of silver, 4,768 pounds of copper, 9,951 pounds of lead, and 440,790 pounds of zinc).

Ruby Valley district.—The Nevada Mining & Development Co. operated the Michigan mine from September 1 to December 17, 1943, and shipped 861 tons of zinc ore for treatment by concentration and smelting; 139 ounces of silver, 18,800 pounds of lead, and 104,700 pounds of zinc were recovered.

Warm Creek (Clover Valley) district.—T. E. Wood operated the Polar Star mine from May 1 to July 30, 1943, and shipped 105 tons of zinc ore containing 44,038 pounds of zinc for treatment by fuming.

ESMERALDA COUNTY

Divide district.—Lessees operating the Divide mine shipped 531 tons of ore, containing 379 ounces of gold and 1,371 ounces of silver, during 1943.

Goldfield district.—The Goldfield Consolidated Mines Co. worked the Goldfield Consolidated mine throughout 1943; 139 tons of ore shipped to a smelter contained 113 ounces of gold, 283 ounces of silver, 1,765 pounds of copper, and 7,384 pounds of lead.

Silver Peak district.—Desert Silver, Inc., operator of the Nivloc mine—largest producer of silver in Nevada from 1938 to 1942 and second-largest in 1943—suspended operations on July 31, 1943. The cyanidation of 20,983 tons of ore yielded 903 ounces of gold and 207,523 ounces of silver. Soon after operations were suspended, machinery at the mine was sold at auction; it was being removed at the end of the year.

EUREKA COUNTY

Cortez district.—M. and K. Elquist operated the Ventura mine from January 1 to August 31, 1943, and shipped 79 tons of ore containing 84 ounces of gold and 48 ounces of silver to a smelter.

Eureka district.—Lessees worked the Colorado mine during 1943; 48 tons of ore shipped to a smelter contained 104 ounces of gold and 207 ounces of silver. Cardinalli & Frank worked the Mountain View mine from August 28 to December 31; 204 tons of zinc ore containing 23 ounces of silver, 14,315 pounds of lead, and 114,622 pounds of zinc were shipped to a smelter.

HUMBOLDT COUNTY

Potosi district.—Getchell Mine, Inc., treated gold ore from the Getchell mine in a 1,000-ton cyanide plant. The arsenic content of the ore, which had required the installation of expensive roasting equipment, proved most welcome when War Production Board Order L-208 went into effect, because this property was permitted to continue operations as a producer of strategic arsenic.

LANDER COUNTY

Battle Mountain district.—The International Smelting & Refining Co. operated its 350-ton flotation mill at the Copper Canyon mine throughout 1943. In addition to copper concentrates, crude copper ore was shipped to a smelter. Lessees worked the Copper Queen mine from August 15 to December 31; 570 tons of copper ore containing 4 ounces of gold, 108 ounces of silver, and 51,537 pounds of copper were shipped to a smelter. Broyles & Wilson worked the Independence group from March 9 to November 13; 266 tons of ore shipped to a smelter contained 137 ounces of gold and 4,682 ounces of silver. Symanzik & Wrobel worked the Trinity mine throughout the year; 647 tons of silver ore (containing 62 ounces of gold, 11,565 ounces of silver, 1,229 pounds of copper, and 53,000 pounds of lead) and 114 tons of lead ore (containing 14 ounces of gold, 3,874 ounces of silver, 480 pounds of copper, and 15,734 pounds of lead) were shipped to a smelter.

Bullion district.—Willow Creek Mines, Inc., worked the Goldacres mine throughout 1943. Ore mined by open-pit methods was treated in the company 300-ton cyanidation mill. Gold ore was shipped to a smelter from the Gold Quartz mine during the year.

Hilltop district.—Govich & Wikberg shipped 16 tons of ore containing 106 ounces of gold, 187 ounces of silver, 129 pounds of copper, and 257 pounds of lead from the Pittsburgh Red Top mine to a smelter during 1943.

New Pass district.—Smith & Snyder amalgamated 100 tons of ore from the Thomas W. mine and recovered bullion containing 45 ounces of gold and 7 ounces of silver.

LINCOLN COUNTY

Groom district.—The International Mining Corporation and Dan Sheahan worked the Groom mine from January 1 to September 30, 1943; 1,367 tons of lead ore treated in the company 50-ton flotation mill yielded 142 tons of lead concentrates containing 2,056 ounces of silver and 152,577 pounds of lead. In addition, 193 tons of ore containing 772 ounces of silver and 59,335 pounds of lead were shipped for direct smelting.

Jack Rabbit district.—The Bristol Silver Mines Co., largest shipper of direct-smelting ore in the State, shipped silver ore containing substantial quantities of base metals from the Bristol Silver mine during 1943.

Pioche district.—The Combined Metals Reduction Co. operated its 500-ton flotation mill on company and custom ore throughout 1943. Company ore was derived from the Abe Lincoln, Amalgamated Pioche, Pioche 802, and Raymond Ely West mines. The mill products were lead concentrate and zinc concentrate, which were shipped for further treatment. In addition to operations by the Combined Metals Reduction Co., the Amalgamated Pioche Mining & Smelting Corporation shipped lead tailings to a smelter from the Amalgamated Pioche mine. The Salt Lake-Pioche Mining Co. worked the Apex and Financier mines, both on company account and through lessees; 428 tons of lead ore (containing 60 ounces of gold, 39,813 ounces of silver, 246 pounds of copper, and 134,069 pounds of lead) were shipped to a smelter from the Apex mine, and 2,776 tons of lead ore (containing 228 ounces of gold, 82,396 ounces of silver, 1,646 pounds of copper, and 838,296 pounds of lead) were shipped to a smelter from the Financier mine. Ely Valley Mine operated the Ely Valley mine throughout 1943 and shipped zinc ore to the Pioche mill of the Combined Metals Reduction Co. The Prince Consolidated Mining Co., which operated the Prince mine, also shipped zinc ore to the Pioche mill of the Combined Metals Reduction Co. In addition, lead ore was shipped for direct smelting.

LYON COUNTY

Yerington district.—During 1943 lessees working the Mason Valley mine shipped to a smelter 1,500 tons of copper ore containing 7 ounces of gold, 271 ounces of silver, and 187,010 pounds of copper. The International Smelting & Refining Co. carried on an extensive exploration and development campaign at the Gelder property during the year; no production was reported.

NYE COUNTY

Manhattan district.—E. J. Hyde worked the Big Four mine during 1943; 60 tons of ore treated by amalgamation yielded 67 ounces of gold and 31 ounces of silver. The Owl Fraction was worked during the year, and 6 tons of ore treated by amalgamation yielded 42 ounces of gold and 15 ounces of silver. John Farrell treated 30 tons of ore mined from the Red Horse mine and recovered 50 ounces of gold and 14 ounces of silver; placer operations at this mine resulted in the recovery of 95 ounces of gold and 42 ounces of silver from the treatment of 450 cubic yards of gravel. The Manhattan Gold Dredging Co. was permitted by the War Production Board to operate from March 27 to December 31. The dredge was equipped with 108 9½-cubic foot buckets.

Quartz Mountain district.—Obie LeFavor worked the San Rafael mine during 1943 and shipped to a smelter 269 tons of lead ore containing 25 ounces of gold, 3,510 ounces of silver, 2,320 pounds of copper, and 61,020 pounds of lead.

Tonopah district.—Several sets of lessees worked parts of the Tonopah Mining Co. of Nevada property throughout 1943 and shipped gold-silver ore to a smelter.

Tybo district.—Hall Bros. Co., Inc., worked the 2–G mine throughout 1943 and shipped ore and old tailings for treatment by concentration and smelting; 537 tons of zinc-lead ore containing 62 ounces of gold, 9,439 ounces of silver, 157 pounds of copper, 100,825 pounds of lead, and 83,767 pounds of zinc were treated at a custom concentration plant; in addition, 2,760 tons of lead ore and 120 tons of lead old tailings smelted contained 251 ounces of gold, 39,520 ounces of silver, 750 pounds of copper, and 450,540 pounds of lead.

PERSHING COUNTY

Antelope district.—Greenan-Kerr Tin Mine carried on a development campaign for copper and tin at the Majuba Hill mine in 1943 from January 1 until June, after which operations were largely confined to stoping copper ore; 7,302 tons of ore containing 70 ounces of gold, 11,080 ounces of silver, and 641,139 pounds of copper were shipped to a smelter. In addition, a small quantity of tin ore was shipped to a concentrator at Toy, Nev., and the concentrates were forwarded to the Longhorn smelter, Texas City, Tex.

STOREY COUNTY

Comstock district.—The Consolidated Virginia Mining Co. carried on an open-pit operation on the Comstock Lode outcrop during May and June 1943 and treated 5,000 tons of ore in a 100-ton flotation mill; 129 tons of gold concentrates containing 265 ounces of gold and 3,373 ounces of silver were shipped to a smelter. The Sutro Tunnel Coalition, Inc., worked the Crown Point and Yellow Jacket mines. The Consolidated Chollar Gould & Savage Mining Co. worked the Overman mine from January 1 to May 1 and from August 1 to December 31; 37,769 tons of ore and 22,572 tons of old tailings treated in the company 400-ton cyanidation mill yielded 2,139 ounces of gold and 28,733 ounces of silver.

WASHOE COUNTY

White Horse district.—The owner and lessees worked the Lode No. 2 mine during 1943 and recovered 119 ounces of gold and 50 ounces of silver from the amalgamation of 21 tons of ore.

WHITE PINE COUNTY

Aurum (*Silver Mountain*) *district.*—The Grand Deposit Mining Co., which had started a development program at the Grand Deposit mine in October 1942, began stoping operations on March 20, 1943. Several classes of ore were produced—292 tons of copper ore contained 3 ounces of gold, 2,160 ounces of silver, 31,475 pounds of copper, and 6,652 pounds of lead; 11 tons of lead ore contained 66 ounces of silver, 223 pounds of copper, and 2,381 pounds of lead; and 1,492 tons of zinc ore contained 9,952 pounds of copper, 22,035 pounds of lead, and 724,376 pounds of zinc.

Robinson district.—The Nevada Consolidated Copper Corporation, which had been the operating subsidiary of the Kennecott Copper Corporation in Nevada for many years, merged with the parent corporation and became known as the Kennecott Copper Corporation, Nevada Mines Division, as of January 1, 1943. This corporation, which operated the Ruth mine at Ruth and the open pit at Copper Flat, as well as the McGill flotation concentrator (daily capacity, 20,000 tons) and the McGill copper smelter, both at McGill, was the largest privately financed industrial organization in Nevada. In addition to being the leading copper producer in the State, the corporation stood first in gold and third in silver output. With the virtual disappearance of shipments of siliceous ore by small producers in White Pine County to the McGill smelter, the company provided silica for its smelter charges by mining oxidized (carbonate) ore which it smelted without concentration. The Consolidated Coppermines Corporation, second-largest copper and third-largest gold producer in the State in 1943, was active throughout the year; copper ore mined on company account was shipped to the McGill concentrator, and small quantities of lead ore and zinc ore were shipped for direct smelting. Late in the year the company began production from a new open pit, known as the Tonopah, under an arrangement with the Metals Reserve Co., which provided for payment above the ceiling price for the copper produced from this very low grade ore.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO

(MINE REPORT)

By Chas. W. Henderson and R. H. Mote

SUMMARY OUTLINE

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SUMMARY

Production of zinc in New Mexico in 1943 was larger in quantity than in any previous year, of lead greater than in any year since 1937, and of copper greater than in any year but record-making 1942. The output of gold decreased 53 percent and silver 31 percent in both quantity and value. The production of gold is the smallest on record since 1876 and of silver the smallest since 1926. The total value of the recovered output of the five metals was $34,042,378 in 1943 compared with $29,542,885 in 1942. Copper represented 58 percent and zinc 38 percent of the total value in 1943.

The Metals Reserve Co. continued its premium-price plan for overquota production of domestic copper, lead, and zinc in 1943. This Government subsidy of metal mining, initiated on February 1, 1942, is to be effective until July 31, 1945; however, the Metals Reserve Co. reserves the right to terminate the program if the national emergency ends before July 31, 1945.

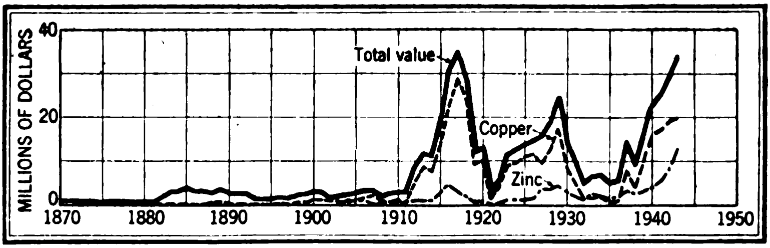

Figure 1.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1870–1943. The value of gold, silver, and lead produced annually has been relatively small.

Early in 1943 the Metals Reserve Co. announced a revised scale of premium payments and established three premium-price classes for zinc, designated A, B, and C. Lead was also included in this set-up because of the close affinity of lead and zinc in ore bodies, but no action was announced for copper. Lead received only one additional premium on the B level of 2¾ cents a pound above the 6½ cents a pound ceiling price and 2¾ cents a pound premium offered throughout most of 1942. Zinc received two additional premiums of 2¾ cents each for B and C classes above the 8¼ cents a pound ceiling price and the 2¾ cents a pound A premium offered in 1942. Whether a property was eligible for all or only part of these premiums was left to the judgment of the quota committee. Effective August 1, 1943, the Metals Reserve Co. announced a new program designed to speed payments to mine operators having zero quotas, wherein such operators were permitted to obtain an advance of 90 percent of their premium allowance at the time ceiling-price settlement was made on individual shipments to the mill, smelter, or processing plant. Circumstances late in 1943 caused a sudden about-face in the Government attitude toward subsidy of the base-metal mines. These circumstances were: Increasing mineral production, greatly revised military requirements, and greater need for manpower than for large stock piles of metals of no immediate use. Accordingly, the War Production Board announced on October 27 that no new B and C premiums would be issued to zinc mines (B premiums were already denied to lead mines not in operation). Copper mines which produced less than 2,000 tons of ore during 1942 and required increased revenue to obtain maximum production were aided by a Reconstruction Finance Corporation plan, announced on May 3, 1943. No specific premium above the existing 5 cents per pound was stated. The mines were given individual consideration as to the premium necessary to insure continuous operation and maximum production.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

The following table shows the number of mines in New Mexico producing gold, silver, copper, lead, and zinc and their annual output of ore and metals from 1939 to 1943, as well as the total production from 1848 to 1943. The report of this series for 1929 (chapter of Mineral Resources of the United States, 1929, pt. 1, pp. 729–759) gives the yearly production of each important metal-producing district in New Mexico from 1904 to 1929, inclusive. Subsequent records year by year may be found in annual issues of Mineral Resources and Minerals Yearbook.

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1939–43, and total, 1848–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	214	168	4,977,375	36,979	$1,294,265	1,400,878	$950,899
1940	164	179	7,089,903	35,943	1,258,005	1,407,839	1,001,130
1941	145	103	7,530,226	27,845	974,575	1,328,317	944,581
1942	78	48	8,221,512	11,961	418,635	676,170	480,832
1943	64	16	8,329,043	5,563	194,705	463,583	329,659
1848–1943			(1)	2,166,304	49,154,833	66,416,329	51,960,697

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	92,284,000	$9,597,536	10,784,000	$506,848	58,712,000	$3,053,024	$15,402,572
1940	139,696,000	15,785,648	7,644,000	382,200	60,626,000	3,819,438	22,246,421
1941	146,956,000	17,340,808	9,336,000	532,152	75,724,000	5,679,300	25,471,416
1942	160,200,000	19,384,200	9,216,000	617,472	92,922,000	8,641,746	29,542,885
1943	152,326,000	19,802,380	11,446,000	858,450	119,048,000	12,857,184	34,042,378
1848–1943	[2] 1,173,707	348,065,563	[2] 255,015	25,007,653	[2] 717,815	96,385,454	570,574,200

[1] Figures not available.

[2] Short tons.

Gold and silver produced at placer mines in New Mexico, 1939–43, in terms of recovered metals

Year	Gold		Silver		Total value	Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value			Fine ounces	Value	Fine ounces	Value	
1939	3,474	$121,590	209	$142	$121,732	1942	1,247	$43,645	135	$96	$43,741
1940	2,928	102,480	263	187	102,667	1943	92	3,220	25	18	3,238
1941	2,488	87,080	284	202	87,282						

Gold.—Mine production of recovered gold in New Mexico decreased from 11,961 fine ounces in 1942 to 5,563 ounces in 1943, the smallest production on record since 1876. The principal gold-producing districts in 1943 were: Central, Grant County, which contributed 49 percent of the State production of recovered gold; Lordsburg, Hidalgo County, 26 percent; Mogollon, Catron County, 13 percent; Steeple Rock, Grant County, 4 percent; Magdalena, Socorro County, 3 percent; and Pinos Altos, Grant County, 2 percent. Copper ore yielded 37 percent of the State total gold; dry and siliceous ores, 29 percent; zinc ore, 17 percent; lead and zinc-lead ores, 15 percent; and placers, 2 percent.

Silver.—Mine production of recovered silver in New Mexico was 463,583 fine ounces in 1943 compared with 676,170 ounces in 1942. The Central district contributed 39 percent of the State total in 1943; Lordsburg, 18 percent; Magdalena, 14 percent; Mogollon, 10 percent; Steeple Rock, 5 percent; Pinos Altos, 4 percent; San Simon, 3 percent; Kingston, 3 percent; Swartz, 1 percent; and Burro Mountain, 1 percent. Zinc-lead ore yielded 50 percent of the total silver; copper ore, 22 percent; zinc ore, 14 percent; dry and siliceous ores, 13 percent; and lead and lead-copper ores and a small amount of silver from placer operations, 1 percent.

Copper.—The mine production of recovered copper in New Mexico in 1943 was 152,326,000 pounds, a 5-percent decrease from the record annual production of 1942. The Chino open-pit mine of the Kennecott Copper Corporation at Santa Rita, Grant County, continued to be by far the largest copper producer in the State; the second-largest continued to be the Banner Mining Co., operating the Bonney mine 6 miles south of Lordsburg; and other substantial producers were the Burro Mountain group of the Phelps Dodge Corporation at Tyrone, Grant County, and the Stauber and Pastura mines near Pastura, Guadalupe County. Copper ore and mine-water precipitates yielded 99 percent of the total copper; virtually all the remainder was recovered from concentrates produced by milling zinc and zinc-lead ores.

Lead.—The production of recovered lead in New Mexico increased 24 percent in quantity in 1943 over 1942. Substantial gains in the Central district, Grant County, and the Magdalena district, Socorro County, brought about the increase. Nearly 50 percent of the total State output of lead came from the American Smelting & Refining Co. Ground Hog mine in the Central district, Grant County. Zinc-lead and zinc ores yielded nearly 97 percent of the total lead, copper and dry and siliceous ores nearly 2 percent, and lead and lead-copper ores nearly 2 percent.

Zinc.—The production of recovered zinc from mines in New Mexico increased 28 percent in 1943, following a 23-percent increase in 1942. Largely responsible for the increase in 1943 was the opening in March 1943 in the Central district, Grant County, of the United States Smelting, Refining & Mining Co. Bullfrog mine and 400-ton selective-flotation mill. The principal producers in 1943 were the Peru Mining Co. (Copper Flat, Kearny, and Pewabic mines), Empire Zinc Co. (Hanover mine group), United States Smelting, Refining & Mining Co. (Bullfrog mine), and American Smelting & Refining Co. (Ground Hog Unit), all in the Central district, Grant County; and the American Smelting & Refining Co. (Waldo mine) and Empire Zinc Co. (Kelly Unit), both in the Magdalena district, Socorro County. Other major zinc-producing districts were the Pinos Altos, Swartz, Steeple Rock, and Burro Mountain, in Grant County; Organ, in Dona Ana County; and Kingston, in Sierra County.

Zinc concentrates produced in 1943 amounted to 127,748 tons containing, as shipped, 1,357 ounces of gold, 158,414 ounces of silver, 1,123,453 pounds of copper, 3,808,435 pounds of lead, and 137,201,445 pounds of zinc. The average zinc content was therefore 53.70 percent.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Catron	2		716	$25,060	47,368	$33,684
Colfax		1	22	770	3	2
Dona Ana	2				938	667
Grant	31	12	3,108	108,780	234,064	166,446
Guadalupe	2		2	70	1,889	1,343
Hidalgo	8		1,477	51,695	98,259	69,873
Luna	1					
Sandoval	1				45	32
San Miguel	1		29	1,015	1,800	1,280
Santa Fe	4	2	45	1,575	557	396
Sierra	4	1	23	805	13,673	9,723
Socorro	6		141	4,935	64,852	46,117
Torrance	2				135	96
	64	16	5,563	194,705	463,583	329,659
Total, 1942	78	48	11,961	418,635	676,170	480,832

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron	1,200	$156					$58,900
Colfax							772
Dona Ana	15,000	1,950	5,000	$375	363,000	$39,204	42,196
Grant	145,739,000	18,946,070	8,301,000	622,575	107,775,000	11,639,700	31,483,571
Guadalupe	1,258,000	163,540					164,953
Hidalgo	5,023,000	652,990	278,000	20,850	87,000	9,396	804,804
Luna			6,000	450	22,000	2,376	2,826
Sandoval	4,000	520					552
San Miguel	4,000	520	58,000	4,350			7,165
Santa Fe	800	104	32,000	2,400	46,000	4,968	9,443
Sierra	44,000	5,720	125,000	9,375	176,000	19,008	44,631
Socorro	218,000	28,340	2,641,000	198,075	10,579,000	1,142,532	1,419,999
Torrance	19,000	2,470					2,566
	152,326,000	19,802,380	11,446,000	858,450	119,048,000	12,857,184	34,042,378
Total, 1942	160,200,000	19,384,200	9,216,000	617,472	92,922,000	8,641,746	29,542,885

Ore sold or treated and gold and silver produced at lode mines in New Mexico in 1943, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Catron	784	716	47,368	Santa Fe	317	22	550
Dona Ana	1,627		938	Sierra	1,623	21	13,673
Grant	8,135,780	3,063	234,049	Socorro	57,317	141	64,852
Guadalupe	17,327	2	1,889	Torrance	220		135
Hidalgo	113,903	1,477	98,259				
Luna	61				8,329,043	5,471	463,558
Sandoval	13		45	Total, 1942	8,221,512	10,714	676,035
San Miguel	71	29	1,800				

Gold and silver produced at placer mines in New Mexico in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Dry-land dredges [1]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Colfax	22	3			22	3
Grant	45	15			45	15
Sante Fe	23	7			23	7
Sierra	2				2	
	92	25			92	25
Total, 1942	286	50	961	85	1,247	135

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

The major elements affecting the mining industry of New Mexico in 1943 continued to be a persistent shortage of experienced mine and mill labor, marked absenteeism, and the gold-mine closing order issued by the Government in October 1942. Although the shortage of labor was more or less constant throughout the year, the Army alleviated the situation somewhat by releasing 4,500 men in the Ninth Service Command for work in copper, zinc, and molybdenum mines; this program began August 12, 1943, and approximately 1,000 men were released each week thereafter until the full quota had been exhausted. New Mexico received 164 of the total 4,500. Absenteeism retarded production at all the large mines, most notably affecting production immediately following pay days. The decreased production of gold and silver in 1943 reflects the effect of the War Production Board Gold Mining Limitation Order of October 1942 on this branch of the metal-mining industry of New Mexico.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in New Mexico in 1943, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	200	882	226	116	1,583	
Dry and siliceous gold-silver ore	904	716	47,380	6,470		
Dry and siliceous silver ore	1,812	35	14,013	6,281	13,422	
	2,916	1,633	61,619	12,867	15,005	
Copper ore	7,571,937	2,058	100,503	[1] 150,733,066	187,158	
Lead ore	586	117	5,054	5,594	188,513	
Lead-copper ore	60		174	3,379	6,660	
Zinc ore	361,391	934	64,154	348,085	1,535,071	58,326,197
Zinc-lead ore	392,153	729	232,054	1,223,009	9,513,593	60,721,803
	8,326,127	3,838	401,939	[1] 152,313,133	11,430,995	119,048,000
Total, lode mines	8,329,043	5,471	463,558	[1] 152,326,000	11,446,000	119,048,000
Total, placers		92	25			
	8,329,043	5,563	463,583	[1] 152,326,000	11,446,000	119,048,000
Total, 1942	8,221,512	11,961	676,170	[2] 160,200,000	9,216,000	92,922,000

[1] Includes 27,744,537 pounds of copper recovered from precipitates from mine water and leached dumps.
[2] Includes 26,042,745 pounds of copper recovered from precipitates from mine water and leached dumps.

METALLURGIC INDUSTRY

The quantity of ore sold or treated in New Mexico in 1943 totaled 8,329,043 tons—largest in any year on record and 107,531 tons higher than the record of 1942. Copper ore sold or treated decreased from 7,631,752 tons in 1942 to 7,571,937 tons in 1943; zinc-lead ore increased from 220,378 to 392,153, most of the increase coming from Grant County; dry and siliceous ores decreased from 37,831 to 2,916; zinc ore increased from 330,239 to 361,391; and lead ore decreased from 694 to 586 tons.

Ore treated at concentrating plants in 1943 comprised nearly 99 percent of the State total output of ore; direct smelting ore 1 percent; the quantity of ore treated at amalgamation mills was negligible; and no ore was treated at cyanidation plants. Of the ore treated at concentrating plants, 7,477,738 tons were copper ore, 392,153 tons zinc-lead ore, 361,330 tons zinc ore, and 138 tons lead ore.

The following nine flotation mills treated 99 percent of the total New Mexico output of ore in 1943: Chino at Hurley; Empire Zinc at Hanover; Hanover Unit near Hanover; Bullfrog near Vanadium; Banner near Lordsburg; Peru near Deming; Waldo near Magdalena; Continental at Silver City; and Southwestern near Duncan, Ariz. (operating on ore from the Carlisle group in the Steeple Rock district, Grant County). The Chino reverberatory smelter of the Kennecott Copper Corporation at Hurley was operated throughout 1943 on company copper concentrates, siliceous copper ore, and copper precipitates recovered by leaching of waste dumps. Virtually all the copper production was marketed in the form of fire-refined copper bars. The destination and treatment of concentrates and ore produced by other operators in the State and shipped to smelters in other States are discussed in the following review by counties and districts.

Figures for the quantity of gravel handled at the 16 small placers worked in 1943 are not obtainable.

Mine production of metals in New Mexico in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	140	62	21	...	...	...
Concentrates smelted	360,796	3,581	376,853	[1] 149,476,321	11,143,411	119,026,000
Ore smelted	97,544	1,828	86,684	2,849,679	302,589	22,000
Placer	...	92	25	...	...	...
	...	5,563	463,583	152,326,000	11,446,000	119,048,000
Total, 1942	...	11,961	676,170	160,200,000	9,216,000	92,922,000

[1] Includes 27,744,537 pounds of copper recovered from smelting of precipitates from mine water and leached dumps.

Mine production of metals from amalgamation mills (with or without concentration equipment) in New Mexico in 1943, by counties, in terms of recovered metals

County	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Grant	30	42	14	---------	---------	---------	---------	---------
Santa Fe	110	20	7	---------	---------	---------	---------	---------
	140	62	21	---------	---------	---------	---------	---------
Total, 1942	[1] 29,302	[1] 3,365	[1] 226,829	---------	---------	---------	---------	---------

[1] Includes 28,802 tons of ore cyanided in 1942, yielding 3,195 ounces of gold and 226,787 ounces of silver; no cyanidation in 1943.

Gross metal content of concentrates (all produced at concentrating mills) from ores mined in New Mexico in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (wet assay) (pounds)	Lead (wet assay) (pounds)	Zinc (pounds)
Copper	223,763	8,202	163,037	[1] 151,048,639	128,131	---------
Lead	3,193	151	68,067	190,059	3,504,984	531,342
Lead-copper	6,092	455	114,064	757,332	5,950,834	1,139,840
Zinc	127,748	1,357	158,414	1,123,453	3,808,435	137,201,445
	360,796	10,165	503,582	[1] 153,119,483	13,392,384	138,872,627
Total, 1942	337,736	9,047	404,658	[2] 161,405,314	10,097,965	109,010,019

[1] Includes 28,330,951 pounds of copper contained in precipitates from mine water and leached dumps.
[2] Includes 26,596,797 pounds of copper contained in precipitates from mine water and leached dumps.

Mine production of metals from concentrating mills in New Mexico in 1943, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper pounds)	Lead (pounds)	Zinc (pounds)
Dona Ana	1,626	430	---------	937	14,773	5,000	363,000
Grant	8,059,857	336,560	2,106	224,610	[1] 144,272,784	8,180,904	107,775,000
Hidalgo	111,013	9,783	1,312	73,673	4,936,976	195,190	87,000
Santa Fe	207	79	2	543	800	32,000	46,000
Sierra	1,435	292	20	12,306	33,482	111,681	176,000
Socorro	57,221	13,652	141	64,784	217,506	2,618,636	10,579,000
	8,231,359	360,796	3,581	376,853	[1] 149,476,321	11,143,411	119,026,000
Total, 1942	8,107,858	337,736	5,652	341,552	[2] 157,754,551	8,614,813	92,594,946

BY CLASSES OF ORE CONCENTRATED

Copper	7,477,738	223,763	1,919	80,239	[1] 147,905,067	70,472	---------
Lead	138	35	---------	406	160	30,275	---------
Zinc	361,330	64,176	933	64,154	348,085	1,529,071	58,304,197
Zinc-lead	392,153	72,822	729	232,054	1,223,009	9,513,593	60,721,803
	8,231,359	360,796	3,581	376,853	[1] 149,476,321	11,143,411	119,026,000

[1] Includes 27,744,537 pounds of copper recovered from precipitates from mine water and leached dumps.
[2] Includes 26,042,745 pounds of copper recovered from precipitates from mine water and leached dumps.

Gross metal content of New Mexico crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	60	820	205	130	1,825	
Dry and siliceous gold-silver	904	716	47,380	6,742		
Dry and siliceous silver	1,812	35	14,013	8,064	16,283	
Copper	94,199	140	20,264	2,917,649	217,450	
Lead	448	117	4,648	6,537	175,914	
Lead-copper	60		174	4,224	7,400	
Total to copper and lead plants	97,483	1,828	86,684	2,943,346	418,872	
Zinc	61				8,443	27,897
Total to zinc plants	61				8,443	27,897
	97,544	1,828	86,684	2,943,346	427,315	27,897
Total, 1942	84,352	1,697	107,654	2,525,818	804,651	404,675

Mine production of metals from New Mexico crude ore shipped to smelters in 1943, by counties, in terms of recovered metals

County	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Catron	784	716	47,368	1,200		
Dona Ana	1		1	227		
Grant	75,893	915	9,425	1,466,216	120,096	
Guadalupe	17,327	2	1,889	1,258,000		
Hidalgo	2,890	165	24,586	86,024	82,810	
Luna	61				6,000	22,000
Sandoval	13		45	4,000		
San Miguel	71	29	1,800	4,000	58,000	
Sierra	188	1	1,367	10,518	13,319	
Socorro	96		68	494	22,364	
Torrance	220		135	19,000		
	97,544	1,828	86,684	2,849,679	302,589	22,000
Total, 1942	84,352	1,697	107,654	2,445,449	601,187	327,054

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Catron County: Mogollon	2		784	716		716	47, 368		47, 368	1, 200			$58, 900
Colfax County: Mount Baldy		1			22	22		3	3				772
Dona Ana County: Organ	2		1, 627				938		938	15, 000	5, 000	363, 000	42, 196
Grant County:													
Burro Mountain	3		3, 209	15		15	3, 683		3, 683	4, 189, 000	104, 000	190, 000	576, 034
Central	15	5	8, 103, 181	2, 718	19	2, 737	181, 260	4	181, 264	141, 256, 000	7, 142, 200	104, 431, 500	30, 402, 241
Eureka	1		298	1		1	3, 057		3, 057	800	25, 800	19, 000	6, 300
Pinos Altos	7	7	10, 391	73	26	99	19, 177	11	19, 188	72, 800	81, 400	1, 337, 000	177, 075
Steeple Rock	1		11, 645	250		250	20, 870		20, 870	202, 800	683, 000	703, 500	177, 158
Swartz	3		7, 030	6		6	5, 995		5, 995	16, 100	264, 600	1, 094, 000	144, 563
White Signal	1		26				7		7	1, 500			200
Guadalupe County	2		17, 327	2		2	1, 889		1, 889	1, 258, 000			164, 953
Hidalgo County:													
Apache	1		332	3		3	2, 125		2, 125	22, 900	57, 000		8, 868
Lordsburg	3		110, 963	1, 440		1, 440	82, 350		82, 350	4, 991, 900	113, 800	41, 500	770, 924
San Simon	3		2, 514	33		33	13, 732		13, 732	1, 200	107, 200	45, 500	24, 030
Sylvanite	1		94	1		1	52		52	7, 000			982
Luna County: Tres Hermanas	1		61								6, 000	22, 000	2, 826
Sandoval County: Cuba	1		13				45		45	4, 000			552
San Miguel County: Willow Creek (Terrero)	1		71	29		29	1, 800		1, 800	4, 000	58, 000		7, 165
Santa Fe County:													
Cerrillos	2		207	2		2	543		543	800	32, 000	46, 000	7, 928
San Pedro	2	2	110	20	23	43	7	7	14				1, 515
Sierra County:													
Chloride	2		145	1		1	1, 073		1, 073	6, 400	12, 400		2, 560
Hermosa	1		3				24		24		600		62
Kingston	1		1, 475	20		20	12, 576		12, 576	37, 600	112, 000	176, 000	41, 939
Las Animas (Hillsboro)		1			2	2							70
Socorro County: Magdalena	6		57, 317	141		141	64, 852		64, 852	218, 000	2, 641, 000	10, 579, 000	1, 419, 999
Torrance County: Scholle	2		220				135		135	19, 000			2, 566
Total New Mexico	64	16	8, 329, 043	5, 471	92	5, 563	463, 558	25	463, 583	152, 326, 000	11, 446, 000	119, 048, 000	34, 042, 378

CATRON COUNTY

Mogollon district.—Operated under lease by N. L. Brown from January 1 to February 15, 1943, the Bearup mine yielded 51 tons of dry gold-silver smelting ore containing 30.6 ounces of gold and 2,064 ounces of silver. In February the Silver Creek Mining Co. leased the property, continued to operate it the remainder of the year, and shipped 599 tons of dry gold-silver ore (containing 473.6 ounces of gold and 35,954 ounces of silver) to the El Paso smelter. Several carlots of clean-up material from the Lehigh Metals Co. Little Fanney mill, closed since June 1942, were shipped to the El Paso smelter.

COLFAX COUNTY

Mount Baldy district (*Baldy, Elizabethtown, Eagle Nest*).—A lessee sluiced during the summer at the Spanish Bar placer and recovered 22 fine ounces of gold and 3 ounces of silver.

DONA ANA COUNTY

Organ district.—The American Smelting & Refining Co. leased and operated the Merrimak mine from May 13 to September 15, 1943, and made regular shipments of zinc-lead sulfide ore to the company Hanover Unit selective-flotation zinc-lead custom mill at Hanover, Grant County. E. R. Woolley operated the Merrimak mine before the American Smelting & Refining Co. leased it; he shipped zinc-copper-lead-silver ore averaging 11 percent zinc to the Hanover Unit custom mill. A 1-ton lot of copper ore was shipped to the El Paso smelter from the Cowpuncher mine.

GRANT COUNTY

Burro Mountain district (*Tyrone*).—At its Burro Mountain mine 13 miles southwest of Silver City, throughout 1943, the Phelps Dodge Corporation continued leaching the old mine workings in place, by percolating water and precipitating copper from the resulting copper-bearing water. The copper content of the leach water and the production of precipitates decreased during the year compared with the 1942 production. L. Yacomo and Marvin Fuller continued production from the Full Moon mine until August 1943, when development failed to reveal additional ore. Zinc-lead sulfide ore totaling 1,581 tons was sent to the Continental Chemical & Ore Co. custom mill at Silver City and to the Hanover Unit custom mill. After closing the Full Moon property, Yacomo and Fuller opened the Contact group of claims and shipped 1,628 tons of zinc-lead sulfide ore to the custom mills at Silver City and Hanover.

Central district (*Bayard, Fierro, Georgetown, Hanover, Santa Rita*).—The Kennecott Copper Corporation Chino Mines Division, largest producer of copper in New Mexico, operated its open-pit mine at Santa Rita and its flotation mill and reverberatory copper smelter at Hurley above capacity throughout 1943. The total production of recovered copper approximated that of 1942. Copper was also recovered from leaching accumulated dump material from the pit and from siliceous copper ore used in the converters as a flux. Molybdenum, gold, and silver are recovered in the concentration mill as byproducts. Two short-head Symons crushers were installed in the secondary crushing plant at the 20,000-ton concentrator (true capacity of the mill at desired grind and optimum metallurgy is 18,000 tons per day). Other additions to the metallurgical plant in 1943 included an unloading and drying plant constructed at the smelter to facilitate handling of copper precipitates and a preheater for raising the temperature of the air used for combustion in the reverberatory furnace. Most of the copper produced at the smelter in 1943 was marketed in the form of fire-refined copper bars. The company also searched for zinc ore on two separated areas of company ownership in the Central district—one (the Oswaldo) adjoining the Empire Zinc Co. property, and the other (the Ivanhoe) a quarter of a mile northwest of the company precipitation plant on Santa Rita Creek. A three-compartment vertical shaft was sunk on each of these properties, and a total of 1,100 feet of drift was driven. The printed annual report of the Kennecott Copper Corporation for 1943 reports that, in connection with the development work at Chino Mines, occurrences of zinc ore have been found and that the prospect of discovering commercial bodies of zinc ore appears favorable.

Zinc production, in terms of recovered metal, in the Central district in 1943 was the greatest in the history of the district and exceeded the 1942 record production by 19,684,300 pounds (23 percent). This remarkable production increase, attained in spite of wartime difficulties caused by labor shortages, Government priorities, and absenteeism, made the Central district the fourth-largest zinc-producing district in the United States, exceeded only by the Tri-State region, New Jersey, and the Coeur d'Alene region, in the order named. The Peru Mining Co. operated its Pewabic and Copper Flat mines continuously during 1943. Development on the Kearny property adjacent to the Pewabic mine during the first part of 1943 proved enough ore reserves so that the company began production from this mine in March 1943. Ore from the Pewabic mine and that from the Copper Flat and Kearny properties, operated by the New Mexico Consolidated Mines Co., a Peru subsidiary, was shipped to the Peru Mining Co. 1,000-ton selective-flotation mill (average 700 tons per day in 1943) at Wemple near Deming (Luna County).

The Empire Zinc Co. operated its Hanover mine group and selective-flotation mill continuously in 1943. Besides ore from the company properties in the Central district, the mill treated ore from the company Lynchburg and Kelly mines at Kelly, Socorro County (credited to Socorro County). Most of the zinc concentrates produced were shipped to the New Jersey Zinc Co. Mineral Point Zinc Division plant at Depue, Ill.; byproduct lead concentrates produced were shipped to the El Paso smelter. The American Smelting & Refining Co. continued to operate its Ground Hog-San Jose property and the leased Hanover milling unit (formerly Combination-Black Hawk mill) throughout 1943. Extensive development was carried on at the Ground Hog property during 1943. An intensive diamond-drilling program was carried out in ground below the 1,600-foot level. The mine is developed by a three-compartment vertical shaft to the 600-foot level and then an inclined winze extending to the 1,800-foot level. During the fall of 1943 work was in progress to sink the winze to the 2,000-foot level. The Hanover milling unit operated at capacity (400 tons per day) throughout 1943, with a backlog input from the company Ground Hog-San Jose group, which produced in addition to zinc-lead-copper-silver milling ore a substantial tonnage of lead-copper-silver ore, which was shipped crude to the El Paso smelter. Approximately 35 percent of the total mill feed was custom ore from the Combination, Hobo, September, Little Goat, and Peerless mines in the Central district; the Columbia, Grandview, Royal John, Patsy, and Mineral Mountain properties in the Swartz (Carpenter) district; the Cleveland, Houston-Thomas, Manhattan, Silver Bell, and Silver Hill mines in the Pinos Altos district; the Contact and Full Moon properties in the Burro Mountain (Tyrone) district; the Hornet mine in the Eureka district; the Merrimak mine near Organ; the Ruth mine near Lordsburg; the Silver Hill property near Steins; the Percha mine near Kingston; the Nitt and Blue Hill mines at Kelly; and the Pennsylvania and Tom Payne properties near Cerrillos.

The United States Smelting, Refining & Mining Co. Bullfrog property at Vanadium contributed much to the increased production of zinc in New Mexico and Grant County in 1943. The selective-flotation mill at the Bullfrog mine began producing concentrates in March 1943. The mill was originally designed for 250 tons per day, but in the late summer additional crushing equipment and flotation units were added to raise the capacity to 400 tons per day. The mill heads contain principally zinc, with a little lead; the mill products are a leady-zinc and a zinc concentrate. Concentrates were shipped to the Dumas (Tex.) smelter and to the Anaconda Copper Mining Co. electrolytic zinc smelter at Great Falls, Mont. Several small shipments of crude ore were made to the El Paso smelter from the Little Goat, Boston Bicket, and Zuniga mines.

Ground sluicing of dry-wash gravels in Gold Creek recovered a little placer gold.

Eureka district.—The Mineral Production Co. operated the Hornet mine most of the year. Crude milling ore averaging 1.20 ounces of silver, 4.83 percent lead, and 6.37 percent zinc was shipped to the Hanover Unit custom mill and to the Shattuck Denn Mining Co. custom mill at Bisbee, Ariz. Two cars of lead-silver ore were shipped to the El Paso smelter.

Pinos Altos district.—R. R. Foster and Roy Tirey, lessees on the Cleveland mine, operated the property from February 20 to December 24, 1943, and shipped 4,046 tons of crude milling ore containing 19 ounces of gold, 17,136 ounces of silver, 45,440 pounds of copper, 47,789 pounds of lead, and 975,717 pounds of zinc to the Hanover Unit custom mill. A lessee on the Cleveland dump made regular shipments throughout the year to the Continental Chemical & Ore Co. custom mill at Silver City. W. S. Harrison operated the Manhattan mine the first 6 months of the year and shipped crude zinc-lead-copper-gold-silver ore to both the Continental Chemical & Ore Co. custom mill and the Hanover Unit custom mill. Lessees on the Houston-Thomas group shipped zinc-lead sulfide ore to the custom mills at Silver City and Hanover. Zinc-lead sulfide ore was also shipped to the Hanover Unit custom mill from the Silver Hill and Silver Bell mines. Crude smelting ore was shipped to the El Paso smelter from the Atlas, Houston-Thomas, and Nellie Bly mines.

Steeple Rock district.—The Exploration Syndicate, Inc., operated the Carlisle group of mines under lease and began production of zinc and lead concentrates in March 1943. Development during the year consisted of unwatering the mine to the 500-foot level and sinking a winze to the 700-foot level. Ore is milled at the Southwestern Minerals Co. mill at Duncan, Ariz.; lead concentrates were shipped to the El Paso smelter, and zinc concentrates were shipped to the Amarillo (Tex.) smelter.

Swartz (or Carpenter or Camp Monarch) district.—The Black Range Development Co. operated the Columbia and Grandview mines throughout the year and produced 5,416 tons of zinc-lead-silver ore which were trucked to the Hanover Unit custom mill. Other producing properties in the Swartz district, all of which shipped to the Hanover Unit custom mill, were the Patsy, Mineral Mountain, and Royal John mines.

White Signal district.—A shipment of 26 tons of copper ore was made during the year from the Liberty Bell claim.

GUADALUPE COUNTY

The Stauber mine near Pastura was operated continuously in 1943 by the Guadalupe Mining Co. Shipments to the El Paso smelter for the year amounted to 13,806 tons of siliceous copper ore containing 969,923 pounds of copper and 1,466 ounces of silver. The Pastura Copper Co. operated its mine northeast of Pastura from April 15 to September 6, when operations ceased because diamond drilling failed to find additional ore. During the period of operations, 3,521 tons of siliceous copper ore averaging 4.84 percent copper were shipped to the El Paso smelter.

HIDALGO COUNTY

Apache district.—A lessee operating the Monarch and Copper Crown claims of the Apache group shipped 207 tons of copper ore and 125 tons of lead ore to the El Paso smelter.

Lordsburg district.—The Banner Mining Co. operated the Bonney and Anita No. 1 mines and the company 500-ton flotation mill 6 miles south of Lordsburg continuously throughout 1943. The main vein, the Bonney, is opened by three shafts, the operating shaft (No. 2) and shafts 1 and 3 (about 400 feet on either side of shaft 2) which are used for ventilation and escapeways. The company proceeded to develop the lower levels of the mine and sank the main shaft an additional 42 feet, giving it a total depth of 1,482 feet at the end of the year. The mill treated an average of 300 tons of ore per day in 1943. The milling circuit is so arranged, however, that the daily tonnage handled can be increased to 500 tons. The product of the mill is copper-gold-silver concentrates which are shipped to the El Paso smelter. Following a Federal Bureau of Mines diamond-drilling program (which disclosed several bodies of commercial-grade copper ore) at the Atwood group of claims on Atwood Hill near Valedon, 4 miles south of Lordsburg, a lessee installed mining equipment, rehabilitated the Atwood shaft, and began producing ore in July. Shipments of siliceous copper ore to the El Paso smelter totaled 830 tons containing 129 ounces of gold, 9,794 ounces of silver, 58,107 pounds of copper, and 46,667 pounds of lead. The National Zinc Corporation, lessee on the Ruth property, continued to ship zinc-lead sulfide ore to the Hanover Unit custom mill (Grant County).

San Simon (Steins) district.—A lessee on the Silver Hill property 9 miles south of Steins shipped 138 tons of lead sulfide ore to the Hanover Unit custom mill (Grant County) in 1943. The Shattuck Denn Mining Co. operated the McGhee mine and lease until April 1943. Zinc-lead sulfide ore shipped to the Shattuck Denn custom mill at Bisbee, Ariz., totaled 742 tons containing 1.09 ounces of gold, 917 ounces of silver, 1,515 pounds of copper, 97,430 pounds of lead, and 66,803 pounds of zinc. R. C. Williams operated the Volcano group of claims (6 miles north of Steins) part of the year and shipped 1,634 tons of dry silver ore to the Miami (Ariz.) smelter.

Sylvanite district.—The Ida May group 10 miles southwest of Hachita was worked until July 1943 and produced 94 tons of copper-gold-silver ore.

LUNA COUNTY

Deming district.—At Wemple near Deming is the 1,000-ton Peru Mining Co. selective-flotation mill; it was operated 365 days in 1943 at an average daily rate of 700 tons on zinc sulfide ore from the company Pewabic, Copper Flat, and Kearny mines near Hanover, Grant County.

Tres Hermanas district.—The Contention mine yielded 61 tons of zinc ore, shipped to the Ozark pigment plant at Coffeyville, Kans.

SANDOVAL COUNTY

Cuba (Nacimiento Mountains) district.—In 1943 the San Miguel mine produced 13 tons of copper ore, which were shipped to the El Paso smelter.

SAN MIGUEL COUNTY

Willow Creek district (Terrero).—The Terrero Mining Co. made several shipments to the El Paso smelter of clean-up material from the dismantled Pecos mill in Alamitos Canyon..

SANTA FE COUNTY

Cerrillos district.—A. B. Stewart reopened the Tom Payne mine 8 miles north of Cerrillos early in 1943; he shipped 97 tons of zinc-lead sulfide ore to the Hanover Unit custom mill (Grant County). The Cerrillos Lead & Zinc Co., lessee on the Pennsylvania mine 12 miles northwest of Cerrillos, shipped 110 tons of zinc-lead sulfide ore to the Hanover Unit custom mill during 1943.

San Pedro or New Placers district.—A lessee worked the Candelaria mine 4 miles from Golden on a small scale and trucked the ore produced to his 10-ton amalgamation mill at Golden for treatment. At the St. Paul mine 40 tons of ore were mined and treated in an amalgamation mill.

SIERRA COUNTY

Chloride (Apache, Cuchillo Negro) district.—A small lot of copper ore was shipped from the New Era group of claims to the El Paso smelter. An operator on the War Baby mine shipped 140 tons of dry silver ore to the El Paso smelter.

Hermosa district.—The only output from the Hermosa district in 1943 was 3 tons of lead-silver ore from the Yankee Girl mine.

Kingston district.—The Percha mine in the Black Range west of Kingston was operated throughout 1943. Zinc-lead sulfide ore totaling 1,435 tons and containing 37.90 ounces of gold, 16,824 ounces of silver, 52,794 pounds of copper, 153,204 pounds of lead, and 231,931 pounds of zinc was shipped to the Hanover Unit custom mill (Grant County). A carlot of crude copper ore was also shipped from the Percha mine to the El Paso smelter.

SOCORRO COUNTY

Magdalena district.—The 1943 production of recoverable zinc and lead from the Magdalena district was the greatest in quantity since 1918. The Ozark Smelting & Mining Co. (subsidiary of the Sherwin-Williams Co.) continued to operate the Waldo mine and 250-ton selective-flotation mill until April 10, when the property was purchased by the American Smelting & Refining Co., which maintained production the remainder of the year. Concentrates produced were shipped to the Dumas (Tex.) smelter of the American Zinc Co. of Illinois, the El Paso smelter, and the Athletic Mining & Smelting Co. at Fort Smith, Ark. The Kelly Unit (Lynchburg and Kelly mines) of the Empire Zinc Co. was worked throughout the year by lessees who shipped zinc-lead ore to the Empire Zinc Co. selective-flotation mill at Hanover and dump ore to the Continental Chemical & Ore Co. custom mill at Silver City. A lessee on the Blue Stone mine shipped 96 tons of lead ore to the El Paso smelter. J. A. McDonald continued to operate the Nitt claim, shipping crude zinc-lead ore to the Hanover Unit custom mill (Grant County), to which also 1 carlot of zinc-lead ore was shipped from the Blue Hill claim.

TORRANCE COUNTY

Scholle district.—Two operators in the Scholle district shipped 220 tons of copper-silver ore to the El Paso smelter during 1943. Sporadically in the past, whenever copper prices were high, this district has shipped siliceous copper ore from shallow ore bodies in the "Red Beds."

GOLD, SILVER, COPPER, LEAD, AND ZINC IN OREGON

(MINE REPORT)

By Charles White Merrill

SUMMARY OUTLINE

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SUMMARY

Gold production in Oregon in 1943 sank to less than 1 percent of the all-time record set just 3 years earlier (in 1940) and was less than 3 percent of the output in 1942. Silver, lead, and copper production also dropped lower than had been reported in a decade. No recovery of zinc has been reported since 1937.

The total value of the gold, silver, copper, and lead (in terms of recovered metals) produced in Oregon was $48,038 in 1943 compared with $1,708,297 in 1942. It was divided among the metals as follows: Gold, 80 percent; silver, 16 percent; copper, 3 percent; and lead, 1 percent. Baker County continued to lead in metal output, but Jackson and Jefferson Counties each produced nearly as much; these three counties supplied 88 percent and the other three producing counties 12 percent of the State total.

Rising wages, enlistment of miners in the armed forces, migration of miners to war industries, rising costs of supplies and equipment and the difficulties of obtaining them, higher taxes, and a fixed price for gold and silver (principal metals produced in the State) were factors that continued to crush the industry in 1943 as they had done in 1941 and 1942. Production, which had sunk to approximately one-third of its 1940 level, quickly collapsed when the War Production Board issued Order L-208 on October 8, 1942. All the larger gold, silver, copper, lead, and zinc mines had suspended operations before January 1, 1943, and none resumed work during the year.

Lode mines contributed 81 percent and placers 19 percent of the gold produced in Oregon in 1943. For a number of years before 1942 lode mines had produced about one-third and placers two-thirds of the gold output.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are bank measure; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787. [5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1939–43, and total, 1852–1943, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	116	201	69,025	93,372	$3,268,020	105,388	$71,536
1940	112	192	105,469	113,402	3,969,070	219,112	155,813
1941	91	153	98,160	96,565	3,379,775	276,158	196,379
1942	48	83	31,728	46,233	1,618,155	87,376	62,134
1943	16	16	2,680	1,097	38,395	10,523	7,483
1852–1943			(2)	5,668,118	126,347,173	5,187,681	4,767,004

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	96,000	$9,984	30,000	$1,410			$3,350,950
1940	176,000	19,888	70,000	3,500			4,148,271
1941	166,000	19,588	118,000	6,726			3,602,468
1942	206,000	24,926	46,000	3,082			1,708,297
1943	12,000	1,560	8,000	600			48,038
1852–1943	[3] 12,332	4,637,215	[3] 741	75,533	[3] 140	$13,846	135,840,771

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] Figures not available.

[3] Short tons.

Gold produced at placer mines in Oregon, 1939–43, by classes of mines and by methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Connected-bucket dredges:					
1939	5	6,267,000	25,028	$875,980	$0.140
1940	6	7,580,000	24,951	873,285	.115
1941	7	6,670,000	24,131	844,585	.127
1942	6	4,725,000	21,641	757,435	.160
1943					
Dragline: [2]					
1939	10	5,964,000	26,257	918,995	.154
1940	23	7,361,000	35,216	1,232,560	.167
1941	25	6,256,000	28,395	993,825	.159
1942	14	2,852,000	13,383	468,405	.164
1943	(3)		5	175	

See footnotes at end of table.

Gold produced at placer mines in Oregon, 1939–43, by classes of mines and by methods of recovery—Continued

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers—Continued.					
Gravel mechanically handled—Continued.					
Suction dredges: [4]					
1941	1	27,000	191	$6,685	$0.248
1942	--------	--------	--------	--------	--------
1943	--------	--------	--------	--------	--------
Nonfloating washing plants: [5]					
1939	13	346,000	2,169	75,915	.219
1940	29	638,000	4,092	143,220	.224
1941	17	567,000	2,757	96,495	.170
1942	6	45,000	380	13,300	.296
1943	(3)	--------	17	595	--------
Gravel hydraulically handled:					
Hydraulic:					
1939	76	440,000	2,585	90,475	.206
1940	82	599,000	2,731	95,585	.160
1941	63	683,000	2,306	80,710	.118
1942	41	306,000	1,420	49,700	.162
1943	10	38,000	124	4,340	.114
Small-scale hand methods: [6]					
Wet:					
1939	83	299,200	4,398	153,930	.514
1940	44	499,300	4,279	149,765	.300
1941	33	438,300	2,553	89,355	.204
1942	12	220,500	1,462	51,170	.232
1943	4	2,750	52	1,820	.662
Dry:					
1939	1	400	13	455	1.138
1940	1	500	21	735	1.470
1941	1	100	3	105	1.050
1942	--------	--------	--------	--------	--------
1943	--------	--------	--------	--------	--------
Underground placers:					
Drift:					
1939	13	5,400	329	11,515	2.132
1940	10	6,200	287	10,045	1.620
1941	6	4,600	94	3,290	.715
1942	4	1,500	50	1,750	1.167
1943	2	250	10	350	1.400
Grand total placer:					
1939	201	13,322,000	60,779	2,127,265	.160
1940	[7] 192	16,684,000	71,577	2,505,195	.150
1941	153	14,646,000	60,430	2,115,050	.144
1942	83	8,150,000	38,336	1,341,760	.165
1943	16	41,000	208	7,280	.178

---

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.

[3] Gold from terminal clean-up; property and equipment not counted as producing.

[4] Includes all placer operations using suction pump for delivering gravel to floating washing plant, except those producing less than 100 ounces of gold, which are included under "Small-scale hand methods"; no suction dredges reported for 1939–40.

[5] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[6] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc.

[7] A mine using more than 1 method of recovery is counted but once in arriving at total for all methods.

Gold.—Production of gold in Oregon in 1943 decreased almost 98 percent compared with 1942—the output from placers 99 percent and that from lode mines 89 percent. Hydraulic operations furnished 60 percent and small-scale hand methods 25 percent of the total placer gold. Virtually all the lode gold was derived from dry gold ore. There were 32 Oregon properties producing in 1943—16 lode mines and 16 placers; none produced as much as $5,500 worth of gold.

Silver.—Silver production in Oregon in 1943 decreased 88 percent compared with 1942. Jefferson County yielded 92 percent of the State total, dry gold ore over 99 percent, and smelting of flotation concentrates 83 percent.

Copper, lead, and zinc.—Copper production sank to 12,000 pounds, the lowest since 1933; lead output was 8,000 pounds, the lowest since 1932. No zinc was reported recovered.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, and lead in Oregon in 1943, by counties, in terms of recovered metals

County	Mines producing[1]		Gold					
	Lode	Placer	Lode		Placer		Total	
			Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Baker	8	1	378	$13,230	34	$1,190	412	$14,420
Curry	1	1	43	1,505	10	350	53	1,855
Grant		4			32	1,120	32	1,120
Jackson and Jefferson[2]	7	3	468	16,380	51	1,785	519	18,165
Josephine		7			81	2,835	81	2,835
	16	16	889	31,115	208	7,280	1,097	38,395
Total, 1942	48	83	7,897	276,395	38,336	1,341,760	46,233	1,618,155

County	Silver (lode and placer)[3]		Copper		Lead		Total value
	Fine ounces	Value	Pounds	Value	Pounds	Value	
Baker	676	$481	6,300	$819			$15,720
Curry	13	9					1,864
Grant	4	3					1,123
Jackson and Jefferson[2]	9,820	6,983	5,700	741	8,000	$600	26,489
Josephine	10	7					2,842
	10,523	7,483	12,000	1,560	8,000	600	48,038
Total, 1942	87,376	62,134	206,000	24,926	46,000	3,082	1,708,297

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] Combined to avoid disclosure of individual outputs.

[3] Sources of total silver as follows—1943: 10,495 ounces from lode mines and 28 ounces from placers; 1942: 80,235 ounces from lode mines and 7,141 ounces from placers.

MINING INDUSTRY

Of the 2,680 tons of ore (including 37 tons of old tailings) sold or treated in Oregon in 1943 Baker County produced 1,283 tons or 48 percent, Jefferson County 1,248 tons or 47 percent, and Curry and Jackson Counties the remaining 149 tons of ore. Almost 99 percent of the ore (including old tailings) was dry gold ore, and the remainder was copper ore.

No connected-bucket dredge, dragline dredge, or nonfloating washing plant, to which gravel was delivered by mechanical means, was in production in 1943. However, final clean-ups at suspended operations resulted in the recovery of some gold, which is credited to dragline dredges and nonfloating washing plants. The only consumption of quicksilver reported for Oregon placer mines in 1943 was at hydraulic operations, where 33 pounds were consumed, or 1 pound of quicksilver for each 4 ounces of gold recovered in 1943 compared with 1 pound of quicksilver for each 30 ounces of gold recovered at hydraulic operations in 1942.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Oregon in 1943, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead
	Ore	Old tailings				
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold ore	2,609	37	885	10,492	5,700	8,000
Copper ore	34		4	3	6,300	
Total, lode mines	2,643	37	889	10,495	12,000	8,000
Total, placers			208	28		
	2,643	37	1,097	10,523	12,000	8,000
Total, 1942	28,653	3,075	46,233	87,376	206,000	46,000

METALLURGIC INDUSTRY

Of the State total ore and old tailings (2,680 tons), 62 percent was treated at two concentrating mills, both using flotation; 31 percent was shipped crude to smelters; and 7 percent was treated in amalgamation and cyanidation mills, all without concentration equipment. Ultimate recovery of 47 percent of the total lode gold was from the smelting of ore and old tailings, 31 percent was as bullion from amalgamation of ore, 17 percent was from the smelting of concentrates, and 5 percent was as bullion from cyanidation of ore. All material requiring smelting was shipped out of the State, as Oregon has no smelters. No data are available covering quicksilver or cyanide consumption at Oregon mills in 1943.

Mine production of metals in Oregon in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ore amalgamated	111	273	91		
Ore cyanided	90	43	10		
Concentrates smelted: Flotation	200	155	8,776	5,000	7,300
Ore and old tailings smelted	829	418	1,618	7,000	700
Total, lode mines		889	10,495	12,000	8,000
Total, placers		208	28		
		1,097	10,523	12,000	8,000
Total, 1942		46,233	87,376	206,000	46,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Oregon in 1943, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal		
	Ore [1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Baker	66	----------	54	50	----------	----------	----------
Jackson	45	----------	219	41	----------	----------	----------
	111	----------	273	91	----------	----------	----------
Total, 1942	515	50	437	95	3	13	1
CYANIDATION MILLS							
Curry	90	----------	43	10	----------	----------	----------
	90	----------	43	10	----------	----------	----------
Total, 1942	4,213	2,625	1,246	204	----------	----------	----------
Grand total: 1943	201	----------	316	101	----------	----------	----------
1942	4,728	2,675	1,683	299	3	13	1

[1] Includes both raw ore and concentrates cyanided but not raw ore concentrated before cyanidation of concentrates.

Mine production of metals from concentrating mills in Oregon in 1943, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal				
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker and Jefferson [1]	1,650	----------	200	155	8,776	5,000	7,300
	1,650	----------	200	155	8,776	5,000	7,300
Total, 1942	17,948	400	1,421	2,250	32,430	172,400	36,300

[1] Combined to avoid disclosure of individual outputs.

Gross metal content of concentrates produced from ores mined in Oregon in 1943, by class of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	200	155	8,776	5,363	10,120	----------
	200	155	8,776	5,363	10,120	----------
Total, 1942	1,424	2,263	32,431	178,303	57,788	18,103

Mine production of metals from Oregon concentrates shipped to smelter in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker and Jefferson [1]	200	155	8,776	5,000	7,300
	200	155	8,776	5,000	7,300
Total, 1942	1,424	2,263	32,431	172,400	36,300

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead
Dry gold	200	155	8,776	5,000	7,300
	200	155	8,776	5,000	7,300

[1] Combined to avoid disclosure of individual outputs.

Gross metal content of Oregon crude ore and old tailings shipped to smelters in 1943, by classes of material

Class of material	Material shipped		Gross metal content			
	Ore	Old tailings	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold	758	37	414	1,615	811	1,221
Copper	34	---------	4	3	6,511	---------
	792	37	418	1,618	7,322	1,221
Total, 1942	5,977	---------	3,951	47,505	36,490	18,985

Mine production of metals from Oregon crude ore and old tailings shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Material shipped		Gold	Silver	Copper	Lead
	Ore	Old tailings				
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker	680	37	261	420	6,300	---------
Jackson and Jefferson [1]	112	---------	157	1,198	700	700
	792	37	418	1,618	7,000	700
Total, 1942	5,977	---------	3,951	47,505	33,600	9,700

BY CLASSES OF MATERIAL

	Ore	Old tailings	Gold	Silver	Copper	Lead
Dry and siliceous gold	758	37	414	1,615	700	700
Copper	34	---------	4	3	6,300	---------
	792	37	418	1,618	7,000	700

[1] Combined to avoid disclosure of individual outputs.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, and lead in Oregon in 1943, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Total value
	Lode	Placer		Lode	Placer	Total				
Baker County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	
Baker	2	1	74	28	11	39	112			$1,445
Cracker Creek	1		644	130		130	391			4,828
Greenhorn		(4)			2	2				70
Sparta	1		17	23		23	100			876
Sumpter		(4)			17	17				595
Virtue	2		486	127		127	52	6,300		5,301
Weatherby	2	(4)	62	70	4	74	21			2,605
Curry County:										
Chetco	1		90	43		43	10			1,512
Sixes		1			10	10	3			352
Grant County:										
Canyon		2			25	25	4			878
Granite		1			1	1				35
Susanville		1			6	6				210
Jackson County:										
Elk Creek	1		8	9		9	21		200	345
Gold Hill	3	2	38	215	31	246	45			8,642
Upper Applegate	1	1	7	4	20	24	3			842
Josephine County:										
Althouse		1			7	7				245
Galice		1			22	22	4			773
Grants Pass		1			13	13	3			457
Greenback [5]		2			23	23	3			807
Illinois River		1			5	5				175
Combined counties and districts [6]	2	1	1,254	240	11	251	9,751	5,700	7,800	17,045
Total Oregon	16	16	2,680	889	208	1,097	10,523	12,000	8,000	48,038

[1] Only those counties and districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 6 and their output included under "Combined counties and districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 10,495 ounces from lode mines and 28 ounces from placers.

[4] Output from a property not classed as a "mine."

[5] Greenback district lies in both Jackson and Josephine Counties.

[6] Includes following districts: Greenback in Jackson County; Ashwood in Jefferson County; and Waldo in Josephine County.

BAKER COUNTY

Baker district.—The Alex Johnson mine shipped gold ore to a smelter during 1943.

Cracker Creek district.—The Ellis Mining Co. recovered a small quantity of concentrates from 500 tons of dump ore run through the company mill to test the machinery; the concentrates, valued primarily for gold, were shipped to a smelter. In addition, a small quantity of gold ore was shipped to a smelter from the company holdings, which included the Eureka and Excelsior, Tabor Fraction, and Columbia mines.

Sparta district.—Gold ore produced at the Richfield mine was treated by amalgamation, and a small quantity was shipped for direct smelting.

Virtue district.—Anthony Brandenthaler took over the Gray Eagle mine in August 1943 and produced ore containing antimony, gold, silver, and copper; 249 tons of gold ore contained 47 ounces of gold and 29 ounces of silver; and 34 tons of copper ore containing 4 ounces of gold, 3 ounces of silver, and 6,511 pounds of copper were shipped to smelters. In addition, a small shipment of gold ore was made to a smelter by operators preceding Brandenthaler.

Weatherby district.—A. V. Lovejoy operated the Lovejoy Mines property in the Chicken Creek section of the Weatherby district intermittently during 1943; 25 tons of ore were amalgamated, from which 32 ounces of gold and 11 ounces of silver were recovered. A shipment of gold ore was made from the Surprise mine as a result of operations from March 1 to July 30, 1943.

CURRY COUNTY

Chetco district.—W. D. Bowser operated the Robert E. mine and cyanided 90 tons of ore which yielded 43 ounces of gold and 10 ounces of silver.

Sixes district.—J. C. Herren worked the Gable mine until March 6, 1943, and hydraulicked 8,000 cubic yards of gravel to produce 10 ounces of gold and 3 ounces of silver.

GRANT COUNTY

Canyon district.—Wallace Tracy hydraulicked at the Tracy claims during 1943.

JACKSON COUNTY

Gold Hill district.—Clarence Harrison worked the Black Channel mine on Hawkins Gulch by hydraulicking from January 3 to March 30, 1943, recovering 15 ounces of gold and 2 ounces of silver. Lance Bros. recovered 12 ounces of gold and 2 ounces of silver by hydraulicking on Foots Creek between January 20 and May 1. Exploration and development at the Solomon group resulted in the production of 36 tons of ore, from which 54 ounces of gold and 16 ounces of silver were recovered. Mardon Bros., lessees on the Sunrise mine, discovered a pocket and recovered 156 ounces of gold and 24 ounces of silver; this mine had the largest gold output in the State for 1943.

Greenback district.—H. B. Warner shipped high-grade gold ore, from intermittent operations at the Warner mine, to a smelter during 1943.

Upper Applegate district.—George R. Lewis hydraulicked on Sterling Creek from February 1 to June 1, 1943; 1,000 cubic yards of gravel yielded 20 ounces of gold and 3 ounces of silver.

JEFFERSON COUNTY

Ashwood district.—Operation of the Oregon King mine by Fenton and Silbaugh, sublessees, was terminated February 26, 1943, and Oregon King Mines, Inc., repossessed the property and carried on operations thereafter. Gold ore was treated in the company 50-ton flotation mill; gold concentrates and a small quantity of gold ore were shipped to a smelter. This mine was Oregon's leading producer of silver and lead in 1943.

JOSEPHINE COUNTY

Greenback district.—C. C. Clark hydraulicked 4,000 cubic yards of gravel at the Goff property between January 1 and May 15, 1943, recovering 14 ounces of gold and 2 ounces of silver.

Waldo district.—Homer White hydraulicked at the Llano de Oro mine from January 1 to May 8, 1943.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN SOUTH DAKOTA

(MINE REPORT)

By Chas. W. Henderson and R. V. Cushman

SUMMARY OUTLINE

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SUMMARY

Metal mining in South Dakota for the production of gold, silver, copper, lead, and zinc was limited to Lawrence County in 1943. Gold mining, the principal mineral industry, experienced a severe set-back in 1943 as a result of the Gold Mining Limitation Order issued by the War Production Board. The two major gold mines still in operation on January 1, 1943—the Homestake mine at Lead and the Bald Mountain Mining Co. mines near Trojan—operated only until June 8, 1943, on reprieves granted them by the War Production Board to complete the milling of broken ore in the stopes. In 1943 the recovered output of gold in the State was 106,444 fine ounces valued at $3,725,540, compared with 522,098 ounces valued at $18,273,430 in 1942, an 80-percent decrease. Besides gold, South Dakota in 1943 produced 35,886 fine ounces of silver valued at $25,519; 82,000 pounds of recovered lead; and 92,000 pounds of recovered zinc. No placer gold was produced in 1943.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787. [5] $0.71111111.

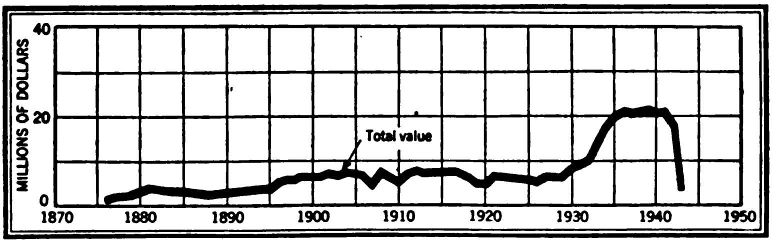

FIGURE 1.—Total value of mine production of gold and silver in South Dakota, 1876–1943.

Mine production of gold, silver, copper, lead, and zinc in South Dakota, 1939–43, and total, 1876–1943, in terms of recovered metals [1]

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	18	80	1, 632, 778	618, 536	$21, 648, 760	167, 584	$113, 754
1940	11	81	1, 667, 370	586, 662	20, 533, 170	175, 514	124, 810
1941	10	41	1, 711, 744	600, 637	21, 022, 295	170, 771	121, 437
1942	5	13	1, 464, 384	522, 098	18, 273, 430	186, 937	132, 933
1943	3		204, 932	106, 444	3, 725, 540	35, 886	25, 519
1876–1943			(2)	20, 666, 485	504, 924, 184	9, 569, 099	6, 807, 080

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939							$21, 762, 514
1940	12, 000	$1, 356	14, 000	$700			20, 660, 036
1941							21, 143, 732
1942	2, 000	242	170, 000	11, 390	230, 000	$21, 390	18, 439, 385
1943			82, 000	6, 150	92, 000	9, 936	3, 767, 145
1876–1943	[3] 105	36, 196	[3] 421	53, 060	[3] 161	31, 326	511, 851, 846

[1] For total production of gold and silver in South Dakota, by years, see Mineral Resources, 1913, pt. 1, p. 42; Mineral Resources, 1922, pt. 1, p. 194; and subsequent volumes of Mineral Resources and Minerals Yearbook.

[2] Figures not available.

[3] Short tons.

Gold and silver produced at placer mines in South Dakota, 1939–43, in terms of recovered metals

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1939	622	$21, 770	47	$32	$21, 802
1940	229	8, 015	21	15	8, 030
1941	93	3, 255	7	5	3, 260
1942	33	1, 155	3	2	1, 157
1943					

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in South Dakota in 1943, by counties, in terms of recovered metals

County	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Lawrence	3	....	204,932	106,444	$3,725,540	35,886	$25,519
	3	....	204,932	106,444	3,725,540	35,886	25,519
Total, 1942	5	13	1,464,384	522,098	18,273,430	186,937	132,933

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Lawrence	....	....	82,000	$6,150	92,000	$9,936	$3,767,145
	....	....	82,000	6,150	92,000	9,936	3,767,145
Total, 1942	2,000	$242	170,000	11,390	230,000	21,390	18,439,385

MINING AND METALLURGIC INDUSTRY

Ore mined and treated at lode mines in South Dakota in 1943 totaled 204,932 tons yielding, in terms of recovered metals, 106,444 fine ounces of gold, 35,886 fine ounces of silver, 82,000 pounds of lead, and 92,000 pounds of zinc. An analysis of methods of treatment shows 183,246 tons treated by amalgamation followed by cyanidation of sands and slimes; 18,772 tons treated by cyanidation, part of which was roasted preceding cyanidation; and 2,914 tons treated by selective-flotation concentration.

METALLURGIC RECOVERY

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1939–43

Year	Ore treated	Gold in bullion	Silver in bullion	Quicksilver used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1939	1,461,283	336,424.93	64,710	9,221
1940	1,479,905	313,964.15	60,254	4,997
1941	1,506,183	328,166.44	62,423	6,537
1942	1,275,138	276,298.00	56,852	3,561
1943	183,246	69,710.02	13,340	508

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1939–43

Year	Material treated				Gold in bullion product	Silver in bullion product	Sodium cyanide used [1]
	Crude ore	Concentrates	Sands and slimes	Total			
	Short tons	*Short tons*	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*
1939	170,270	[2]61	1,443,548	1,613,879	279,889.77	102,317	887,888
1940	187,360	....	1,432,244	1,619,604	269,518.82	111,607	883,849
1941	205,356	....	1,499,000	1,704,356	270,989.89	106,437	903,680
1942	161,635	[3]366	1,271,305	1,433,306	244,421.00	122,312	801,478
1943	18,772	....	178,318	197,090	36,675.52	17,964	[4]149,326

[1] In terms of 96- to 98-percent strength.

[2] From 1,143 tons of ore treated by flotation.

[3] From 17,614 tons of crude ore treated by table and jig concentration.

[4] Includes 263,165 pounds of calcium cyanide (48- to 49-percent strength); all reduced to equivalent of 96- to 98-percent strength to conform with earlier use of figures for high-strength NaCN and KCN.

REVIEW BY COUNTIES

LAWRENCE COUNTY

Homestake mine.—Curtailed operations at the Homestake mine, owned and operated by the Homestake Mining Co. since 1877, were carried on from January through May 1943. They included only the hoisting and milling of 183,246 tons of broken ore (of higher grade than that milled in 1942) remaining in the shrinkage stopes. The annual report of the general manager of the Homestake Mining Co. for the year ended December 31, 1943, says—

> Operation of the mine was suspended in accordance with Order L-208 of the War Production Board except for the hoisting and milling of ore previously broken, which was permitted until June 8, 1943, and maintenance work.
>
> Production from broken ore in shrinkage stopes amounted to 183,246 tons from which, together with recoveries from solutions and clean-up of the circuits, the realization was $3,629,507.33. The last ore was hoisted on May 26, 1943, and the final bullion shipment was made on June 8, 1943.
>
> The reserve of developed ore is 19,005,835 tons, which includes 91,685 tons of broken ore remaining in shrinkage stopes. This remaining broken ore is in stopes which were at a stage that would make resumption of stoping costly if the stopes were emptied.
>
> The campaign of cleaning up and shipping all possible iron and steel scrap was continued. Shipments during 1943 were as follows: Miscellaneous steel scrap, 2,204,820 pounds; manganese steel scrap, 510,340 pounds.
>
> In addition to maintenance work, the machine shops and foundry continued throughout the year on a variety of war production jobs. This war work entailed some preparation and the addition of some equipment to increase shop output.
>
> The sawmill at Spearfish, S. Dak., continued to operate at capacity producing commercial lumber. 98.9 percent of shipments was on orders with AA priority rating.
>
> As a result of the great reduction in the consumption of coal at the Homestake Power Station, production of coal from the Wyodak mine during the first 9 months of the year was the lowest in 15 years. Beginning in September, demand for coal by outside consumers increased rapidly and new production records were made in November and December. Results for the year were satisfactory.
>
> Through an agency contract with the Metals Reserve Co., your subsidiary, the Wyodak Coal & Mfg. Co., continued exploration for vanadium in western Wyoming and eastern Idaho. The exploration work ceased in November and the agency contract was terminated as of December 31, 1943.
>
> Option on the manganese property in Lower California, Mexico, was exercised. Small shipments of hand-sorted product were made during the year. Mill and plant are now under construction.
>
> The Homestake mine and plant have been maintained in excellent condition in order to be in readiness for operation when Government restrictions are withdrawn.
>
> Four hundred and twenty former employees are now with the armed forces.

Ore milled, receipts, and dividends, Homestake mine, 1939–43 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1939	1,400,015	$19,922,964.60	$14.2300	$9,041,760
1940	1,433,737	19,014,767.73	13.2624	9,041,760
1941	1,499,988	19,529,080.70	13.0195	9,041,760
1942	1,275,138	17,068,437.84	13.3856	7,534,800
1943	183,246	3,629,507.33	19.8067	----------

[1] From 1876 to 1943, inclusive, this mine yielded bullion and concentrates that brought a net return of $439,239,773 and paid $149,805,802 in dividends.

No development was done by the company in 1943. Surface treatment plants operated (besides the primary crushing plants at the hoists) comprised the South mill, which includes the main secondary crushing (including 180 stamps), grinding, and amalgamation plant, with a capacity of 3,800 tons per 24 hours, cyanide sand plant No. 1 (capacity 1,600 tons per 24 hours), cyanide sand plant No. 3 (capacity 600 tons per 24 hours), and the refinery, all at Lead; and the slime plant at Deadwood (capacity 2,000 tons per 24 hours). Gold bullion was shipped to the Denver Mint.

Other mines.—The Bald Mountain Mining Co., the only other producing gold-mining company in the State in 1943, operated its consolidated group of mines and 370-ton all-sliming cyanide mill at Trojan under a War Production Board reprieve until June 8, 1943. Ore was produced from the Portland, Dakota, and Clinton claims, and a daily average of 124 tons was treated at the mill. A total of 18,772 tons of dry gold ore was milled, from which 2,714 fine ounces of gold and 11,240 fine ounces of silver were recovered. Following primary crushing, the refractory sulfide ores not amenable to treatment by straight cyanidation (about 15 percent of the ore produced) are by-passed, dry rod-milled to 10-mesh, roasted in the 110-ton gas-fired rotary hearth furnace, and then returned to the mill circuit and mixed with the oxide ores for cyanidation. The net return from metals produced in 1943 was $102,387.

The Belle Eldridge Gold Mines, Inc., operated continuously throughout 1943 its group of claims in Spruce Gulch in the Whitewood district, 2 miles south and east of Deadwood. Production came entirely from the Helen Gould and Josie claims and was milled at the company 50-ton selective-flotation mill on the property. Lead concentrates assaying 0.525 ounce of gold and 31.5 ounces of silver per ton, 45.95 percent lead (wet assay), and 6.81 percent zinc were shipped to the Leadville (Colo.) smelter, and zinc concentrates assaying 0.043 ounce of gold and 2.86 ounces of silver per ton, 1.97 percent lead (wet assay), and 48.79 percent zinc were shipped to the smelter at Amarillo, Tex. Development in 1943 consisted of 250 feet of drifts, 500 feet of tunnel, and 1,538 feet of diamond drilling.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN TEXAS

(MINE REPORT)

By Chas. W. Henderson and R. H. Mote

SUMMARY OUTLINE

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SUMMARY

Mines in Texas produced (in terms of recovered metals) 4 fine ounces of gold, 10,284 fine ounces of silver, 162,000 pounds of copper, and 26,000 pounds of lead in 1943, having a total value of $30,463, compared with 236 ounces of gold, 672,781 ounces of silver, 198,000 pounds of copper, and 362,000 pounds of lead in 1942, having a total value of $534,894.

From 1885 through 1942 silver has been the principal metal produced in Texas, and most of the output has come from the Presidio mine at Shafter, Presidio County. This property ceased operations in September 1942; soon afterward all equipment at the property was dismantled and sold. Recovery of some gold and lead with the silver has made this mine the largest all-time producer in the State of these metals also. The silver produced in 1943 came largely from the Hazel mine in Culberson County and the Plata Verde mine in Hudspeth County. Dry silver ore from the Sancho Panza mine, also in Hudspeth County, and the Hazel mine yielded the bulk of the copper. Virtually all the lead produced came from the Diablo mine in Hudspeth County. No zinc has been recovered from ores mined in Texas since 1917.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939-43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

---

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939-41: Yearly average weighted price of all grades of primary metal sold by producers; 1942-43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

MINE PRODUCTION

The following table shows the annual output of ore and the quantity and value of the metals recovered from Texas mines from 1939 to 1943, as well as the total metal production from 1885 to 1943.

Mine production of gold, silver, copper, lead, and zinc in Texas, 1939–43, and total, 1885–1943, in terms of recovered metals

Year	Ore (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
1939	141,795	324	$11,340	1,341,945	$910.896
1940	146,936	312	10,920	1,326.150	943.040
1941	140,818	306	10,710	1,096.027	779,397
1942	100,698	236	8.260	672,781	478.422
1943	4,134	4	140	10,284	7,313
1885-1943	(1)	8,281	223,780	33,196,821	23.360,028

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	68,000	$7,072	454.000	$21.338			$950,646
1940	60.000	6,780	410,000	20,500			981.240
1941	12,000	1,416	372,000	21,204			812,727
1942	198,000	23,958	362,000	24,254			534,894
1943	162,000	21.060	26,000	1,950			30,463
1885-1943	[2] 1,136	323,171	[2] 4,788	489,449	[2] 744	$106,491	24,502,919

[1] Figures not available.

[2] Short tons.

Mine production of gold, silver, copper, and lead in Texas in 1943, by counties, in terms of recovered metals

County	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Culberson	2	1,223		5.926	44,000	
Hudspeth	6	2.911	4	4,358	118,000	26,000
	8	4.134	4	10,284	162.000	26,000
Total, 1942	7	100,698	236	672,781	198.000	362,000

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Texas in 1943, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry and siliceous gold ore	1	39	4	43		2,699
Dry and siliceous silver ore	5	3,601		9,988	135,239	466
Copper ore	1	339		98	19,761	
Lead ore	1	155		155	7,000	22,835
	8	4,134	4	10.284	162,000	26,000
Total, 1942	7	100,698	236	672,781	198,000	362,000

SMELTING AND REFINING PLANTS IN TEXAS

In 1943 two horizontal-retort zinc smelters (one has a cadmium (metal)-recovery plant), one electrolytic zinc smelter (with a cadmium (metal)-recovery plant), one copper smelter, one lead smelter, one antimony smelter, one tin smelter, three magnesium plants (two designed to extract magnesium electrolytically from sea water), and one electrolytic copper refinery were in operation in Texas.

The American Smelting & Refining Co. continued to operate its copper and lead smelters in El Paso in 1943, treating domestic ores and concentrates purchased from operators in Arizona, New Mexico, Texas, and Virginia, and foreign ores and concentrates purchased from operators in Mexico, Bolivia, Ecuador, Chile, and southwestern Africa. Lead concentrates produced at the company mine at Buchans, Newfoundland, were also treated at the El Paso lead smelter.

The American Smelting & Refining Co. gas-fired horizontal-retort zinc smelter at Amarillo operated throughout the year on zinc concentrates purchased from operators in Arizona, Colorado, New Mexico, Montana, Nevada, and South Dakota and in Mexico. The company was unable to operate the smelter at more than half capacity, however, due to the serious shortage of skilled smelter workers in the area. The company electrolytic zinc plant at Corpus Christi operated throughout the year (successful operations of this unit began in August 1942) but treated only foreign concentrates, some of which came from American Smelting & Refining Co. operations at Buchans, Newfoundland.

The Machovec gas-fired horizontal-retort zinc smelter of the American Zinc, Lead & Smelting Co. at Dumas was operated throughout the year, but only at half capacity because of an acute shortage of experienced smelter workers. Production of cadmium at the cadmium-recovery plant was increased substantially during the latter half of 1943.

Blister copper anodes produced at Phelps Dodge Corporation smelters in Arizona continued to be refined in the corporation Nichols electrolytic refinery at El Paso.

The Federal Bureau of Mines maintained several projects in Texas in 1943 to determine potential sources of strategic war metals. These projects included: Tests for the production of sponge iron from a deposit in the Longview section of east Texas; exploration of celestite deposits in Nolan County for the production of strontium; exploration of mercury deposits at Terlingua on the Rio Grande in west Texas; drilling of zinc deposits in Hudspeth County, west Texas; and exploration of fluorspar deposits near Van Horn.

MINES REVIEW BY COUNTIES

Culberson County.—Dry silver ore totaling 1,218 tons, containing 5,801 ounces of silver and 45,645 pounds of copper, was shipped to the El Paso smelter from the Hazel mine in the south end of the Sierra Diablo Range 14 miles northwest of Van Horn; A. P. Williams operated the property in 1943. A small lot (5 tons) of dry silver ore, containing 125 ounces of silver and 144 pounds of copper, was shipped to the El Paso smelter from the Needle Peak open-cut mine near Van Horn.

Hudspeth County.—Lessees on the Black Shaft mine in the Allamoore district 9 miles northeast of Allamoore shipped 339 tons of copper ore, containing 98 ounces of silver and 20,584 pounds of copper, to the El Paso smelter. Intermittent operations during the year at the Diablo mine produced 155 tons of lead ore containing 155 ounces of silver, 10,445 pounds of copper, and 26,006 pounds of lead. A lessee worked the Michael Robert mine during the first half of 1943 and shipped 395 tons of dry silver ore, containing 78 ounces of silver and 17,041 pounds of copper, to the El Paso smelter. M. F. Drunzer operated the Sancho Panza mine 7 miles northeast of Allamoore from January to June 1943 and shipped 1,727 tons of dry silver ore containing 739 ounces of silver and 75,607 pounds of copper. J. S. Barlow and associates operated the Bona mine 6 miles southwest of Sierra Blanca from August to October 1943 and produced 39 tons of dry gold ore containing 3.50 ounces of gold, 43 ounces of silver, 2,999 pounds of lead, and 1,440 pounds of zinc. A lessee on the Plata Verde mine 14 miles southwest of Van Horn shipped 256 tons of dry silver ore, containing 3,245 ounces of silver and 1,758 pounds of copper, to the El Paso smelter.

Presidio County.—From 1885 to September 1942, when the property was shut down, the Presidio mine at Shafter produced (in terms of recovered metals) 30,293,606 ounces of silver. All surface and underground equipment was dismantled and moved from the property during the early part of 1943.

Production of silver from the Presidio mine from 1885 to 1942 is shown in the table on page 480 of Minerals Yearbook, 1942.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH

(MINE REPORT)

By G. E. Woodward and Paul Luff

SUMMARY OUTLINE

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SUMMARY

The total value of the gold, silver, copper, lead, and zinc produced from Utah ores and gravels in 1943 was the greatest in the history of the State and exceeded that of any other State in the Union. This value was, in terms of recoverable metal, $124,562,540 compared with $113,552,848 in 1942, a 10-percent gain. The larger output of copper and zinc, plus a higher average price for the base metals, accounted for the gain. Production of gold, silver, and lead showed decreases. The total advance in value of the State metal output can be credited almost entirely to the Bingham district, although the Tintic district gained in output of zinc and the Park City region in output of lead. The Utah Copper Co. exceeded its previous record production and supplied about 76 percent of the value of the total metal output of the State. The output of silver and zinc from Tooele County increased, whereas that of each of the other metals decreased.

The full productive capacity of Utah mines was not reached in 1943, as the stimulating effect of premium prices was more than offset by a critical shortage of labor. The shortage became very acute during the summer months, and to offset a declining production of base metals the Army again furloughed about 4,500 soldiers to base-metal mines in the West. Of this number the Utah mines received about 400. The soldiers were released only to copper, zinc, and molybdenum mines, and to these classes of mines according to the stated request of each mine for labor and according to its productivity per man-shift. Several mines, particularly those producing large quantities of lead, were unable to qualify for soldiers; however, some of these mines were later given an opportunity to hire soldiers rejected for physical reasons, who, although not completely satisfying requirements, did tend to bring the crews to an operating minimum. Very few among them could meet the minimum requirements of an experienced miner. At the end of 1943, about 85 percent of the former soldiers were still employed by the mining companies.

The Government policy of premium payments for overquota production was in force throughout 1943; however, toward the end of 1943 certain modifications in the program were necessitated by increased mineral production, revised military requirements, a greater need for marginal manpower than marginal production, and the success of efforts toward balancing the metal supply with the requirements of the armed forces and the most essential civilian uses. Accordingly, on October 27, the War Production Board took the following action. Premium prices in the B range for lead mines and the B and C ranges for zinc mines were denied to mines not already operating and to mines having a low labor productivity and in areas of serious labor shortage. The Government will not now finance new zinc projects. On November 9 the Board stated that after December 31, 1943, no applications for special copper premium prices under the plan effective since May 1, 1943, would be considered.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of January 31, 1934. Treasury legal coinage value of gold from January 18, 1837, to January 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1939–43, and total, 1864–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	175	11	21,094,097	277,751	$9,721,285	10,758,657	$7,302,846
1940	191	21	27,939,346	355,494	12,442,290	12,172,299	8,655,857
1941	167	12	31,952,817	356,501	12,477,535	11,395,485	8,103,456
1942	123	6	34,981,655	391,544	13,704,040	10,574,955	7,519,968
1943	110	1	37,386,731	390,470	13,666,450	9,479,340	6,740,864
1864–1943			(1)	9,840,243	244,633,545	701,354,446	511,016,100

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	343,780,000	$35,753,120	135,268,000	$6,357,596	69,052,000	$3,590,704	$62,725,551
1940	463,728,000	52,401,264	151,376,000	7,568,800	87,576,000	5,517,288	86,585,499
1941	533,676,000	62,973,768	139,202,000	7,934,514	84,098,000	6,307,350	97,796,623
1942	613,382,000	74,219,222	143,860,000	9,638,620	91,086,000	8,470,998	113,552,848
1943	647,978,000	84,237,140	130,514,000	9,788,550	93,792,000	10,129,536	124,562,540
864–1943	[2] 4,277,206	1,197,945,703	[2] 4,294,993	467,139,012	[2] 882,095	114,443,161	2,535,177,521

[1] 1864–1901: Figures not available; 1902–43: 493,734,369 tons produced.

[2] Short tons.

Gold.—Although virtually all the mines active in Utah in 1943 were primarily base-metal mines, the State gold production exceeded that of any other State. The production in 1943 was 390,470 fine ounces compared with 391,544 ounces (highest in the State's history) in 1942. Base-metal ores yielded 92 percent of the State total, and siliceous ores virtually all the rest; placer-gold production was negligible. The gold-mine closing order issued in October 1942 has had little effect on the Utah gold production; however, the order has made it more difficult for the smelters in the Salt Lake Valley to meet the requirements of silica for flux. Only two mines producing gold ore in quantity were active in 1943; these, because of the siliceous nature of their ore, had received permission from the War Production Board to remain in operation. Copper ore furnished 79 percent of the State gold, and siliceous ores 8 percent; the remainder came from zinc-lead ore, slag, lead ore, zinc ore, zinc-lead-copper ore, lead-copper ore, and placers. Ores of the Bingham district, by far the most important gold-producing area in Utah, yielded 343,551 ounces—a gain of 16,293 ounces compared with 1942; however, this gain did not offset the losses from the Park City region, the Tintic district, and the Camp Floyd district (in Tooele County). The gain in the Bingham district was the result of extraordinarily large production of byproduct gold from operations at the Utah Copper Co. and of smaller gains from the National Tunnel & Mines Co. and the Boston Consolidated properties. The Tintic district produced 22,470 ounces of gold and was second in importance

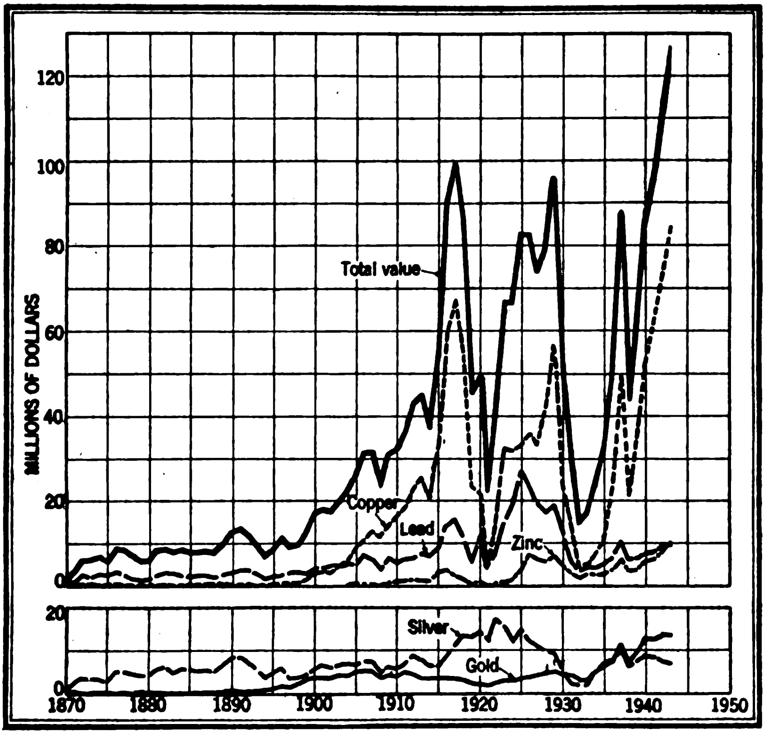

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Utah, 1870–1943.

as a gold producer; the decrease from 1942 was due to the smaller quantity of siliceous ore. The Park City region, third in importance, in 1943 produced 19,559 ounces of gold, a decline of 3,376 ounces compared with 1942; gains at the New Park Mining Co. did not offset losses at the Silver King Coalition Mines Co. and the Park Utah Consolidated Mines Co. Tooele County showed a notable decrease in 1943, as the gold mines in the Camp Floyd district produced a much smaller quantity of gold than in recent years. Ores of all classes treated in concentrating mills yielded 90 percent of the State total gold and ore shipped direct to smelters, slag fumed, and placers the remainder.

The Utah Copper Co. produced about 79 percent of the State production of gold and was followed by the United States & Lark mines at Bingham, the New Park Mining Co. property in the Park City region, the Tintic Bullion property in the Tintic district, the Boston Consolidated property in the Bingham district, the Eureka Bullion property in the Tintic district, the Mammoth mine in the Tintic district, and the Tintic Standard mine in the Tintic district; these eight properties produced 95 percent of the State total.

Silver.—The output of recoverable silver in Utah in 1943 was 9,479,340 fine ounces, a decrease of 10 percent compared with 1942. Production from mines in the Bingham district was slightly more and in Tooele County considerably more than in 1942, but substantial decreases were noted in the Park City region and the Tintic district. Zinc-lead, zinc, and zinc-lead-copper ores yielded 48 percent of the State total, copper ores 31 percent, siliceous ores 16 percent, and lead and lead-copper ores 5 percent. Ore concentrated yielded 79 percent of the State total and crude ore shipped direct to smelters virtually all the remainder. The Bingham district continued to be the chief source of silver, followed by the Park City region, the Tintic district, and Tooele County.

The Utah Copper mine was again the chief silver producer in the State, followed by the United States & Lark, Silver King Coalition, Tintic Standard, Mayflower, Park Utah Consolidated group of properties, Calumet, Harold (dump), and Chief Consolidated group of properties; these properties produced 87 percent of the State output of silver.

Copper.—The output of recoverable copper in Utah in 1943 was 647,978,000 pounds, or 34,596,000 pounds more than in 1942. This output surpassed by far that of any year in the history of the State. The Utah Copper Co. exceeded its previous production record and accounted for almost the entire gain in copper output, although gains were noted also in the National Tunnel & Mines Co. operation. The Utah Copper Co. mined about 80,000,000 tons of ore and waste in 1943 at its open-pit mine at Bingham, at the rate of 1¼ tons of waste to 1 ton of ore. The company mills at Magna and Arthur treated about 97,000 tons of copper ore a day, although the rated capacity of the plants is only about 78,000 tons. Copper ore mined in Utah totaled 35,999,656 tons in 1943, compared with 33,611,061 tons in 1942; the total value of the gold, silver, copper, and lead recovered from copper ore and precipitates was $96,126,788, or 77 percent of the State total value of all five metals.

Following the Utah Copper Co., the chief copper producers in Utah included the National Tunnel & Mines Co., Ohio Copper Co., United States & Lark mines, and the Boston Consolidated mine—all in the Bingham district.

During the first 4 months of 1944 Utah was producing about 52,000,000 pounds of copper a month—a rate calculated to show a decrease during the year of 24,000,000 pounds compared with 1943.

Lead.—During 1943 the principal lead-producing mines in Utah experienced an acute shortage of labor, and little help was given by the Army when soldiers were furloughed for service in base-metal mines. The output of lead in Utah was 130,514,000 pounds of recoverable metal compared with 143,860,000 pounds in 1942. Decreases were noted in each of the chief lead-producing areas except the Park City region. The Bingham district remained the principal lead-producing area in the State, although an 11-percent decrease was noted; losses at the United States & Lark mines accounted for virtually all the decline. The Tintic Standard mine in the Tintic district caused the decrease in that district; whereas in the Park City region increased lead output from the Silver King Coalition mine, the Park Utah Consolidated mine, and the New Park Mining Co. property in 1943 more than offset the loss sustained by the closing in 1942 of the Park City Consolidated mine; the New Park Mining Co. increased greatly its lead output compared with 1942. A considerable quantity of lead was recovered in 1943 from the treating of siliceous ore dumps from the Tintic district; most of this material contained about 3 percent lead and was shipped crude to smelters for flux. The Calumet mine was again the chief lead producer in Tooele County.

The United States & Lark property in the Bingham district was the chief producer of lead in Utah, followed by the Silver King Coalition and Park Utah Consolidated mines in the Park City region, Tintic Standard mine in the Tintic district, Mayflower mine in the Park City region, Calumet mine in Tooele County, Chief Consolidated properties in the Tintic district, and Hidden Treasure mine in Tooele County; these eight properties produced 89 percent of the State total.

Production reports received during the first 4 months of 1944 indicate that the lead production in 1944 will show a decrease of about 6,500,000 pounds compared with 1943. A shortage of experienced labor may result in an even greater decline.

Zinc.—The production of recoverable zinc in Utah rose from 91,086,000 pounds in 1942 to 93,792,000 pounds in 1943. Zinc recovered from old and current slag accounted for most of the gain, as zinc recovered from zinc-lead ores and zinc ores was about the same as in 1942. As in former years, mines in the Bingham district and the Park City region were the principal sources of zinc in Utah; although there was a slight gain in the Bingham district it was more than offset by losses in the Park City region. Substantial gains were noted from mines in the Tintic district, but this district is of minor importance compared with the Bingham and Park City areas. Slight gains at the United States & Lark and Butterfield properties brought about the rise in the Bingham district. Losses at the Silver King Coalition and Park Utah Consolidated mines more than offset a gain of over 3,000,000 pounds at the New Park Mining Co. property in the Park City region. The Chief Consolidated mine produced virtually the entire output from the Tintic district in 1943. The Calumet mine in Tooele County showed a slight increase. All zinc and zinc-lead concentrates produced in Utah in 1943 were treated at the Anaconda and Great Falls (Montana) zinc plants of the Anaconda Copper Mining Co. Zinc fume derived from the fuming of current slag, cold slag, and crude ores was first deleaded and then shipped to Bartlesville, Okla., for further treatment. The zinc recovered from the fuming of current slag and crude ores has not been credited entirely to Utah; the zinc ultimately recovered from the fuming operation, which originates from ores and concentrates containing at least 6 percent zinc, has been credited (along with the tonnage of ore and concentrates) to the State of origin.

The principal producers of zinc in Utah in 1943, named in order of output, were: United States & Lark mines, Tooele slag-fuming plant, Mayflower mine, Park Utah Consolidated mines, Silver King Coalition property, Chief Consolidated properties, Calumet mine, and Butterfield group of properties; these eight properties produced 96 percent of the State total zinc.

According to calculations based on reports received during the first 4 months of 1944, the recoverable zinc output of Utah in 1944 will be about 96,000,000 pounds; however, this production will not be reached should the anticipated acute labor shortage be realized.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Utah in 1943, by counties, in terms of recovered metals

County	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (all lode)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Beaver	7		10,636	238	$8,330	37,395	$26,592
Box Elder	3		647	6	210	450	320
Iron	1		413	1	35	90	64
Juab	15		108,597	5,459	191,065	519,840	369,664
Millard	1	1	291	4	140		
Piute	3		1,183	184	6,440	8,370	5,952
Salt Lake	23		36,533,190	343,614	12,026,490	5,413,410	3,849,536
San Juan	1		8				
Summit	11		296,692	2,295	80,325	1,354,770	963,392
Tooele	24		207,533	4,352	152,320	456,795	324,832
Utah	16		161,097	17,052	596,820	1,041,345	740,512
Wasatch	4		66,258	17,264	604,240	646,785	459,936
Washington	1		191	1	35	90	64
	110	1	37,386,731	[1] 390,470	13,666,450	9,479,340	6,740,864
Total, 1942	123	6	34,981,655	[2] 391,544	13,704,040	10,574,955	7,519,968

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	118,500	$15,405	279,400	$20,955	726,500	$78,462	$149,744
Box Elder	3,000	390	109,800	8,235	119,000	12,852	22,007
Iron	500	65	50,400	3,780	126,500	13,662	17,606
Juab	318,100	41,353	4,250,200	318,765	4,307,000	465,156	1,386,003
Millard			200	15	103,500	11,178	11,333
Piute	4,000	520	77,000	5,775	42,500	4,590	23,277
Salt Lake	644,507,200	83,785,936	71,064,400	5,329,830	46,937,500	5,069,250	110,061,042
San Juan	200	26					26
Summit	666,800	86,684	23,924,000	1,794,300	14,195,000	1,533,060	4,457,761
Tooele	320,500	41,665	10,313,000	773,475	18,064,500	1,950,966	3,243,258
Utah	1,368,500	177,905	12,325,400	924,405	392,000	42,336	2,481,978
Wasatch	598,300	77,779	8,120,200	609,015	8,778,000	948,024	2,698,994
Washington	72,400	9,412					9,511
	647,978,000	84,237,140	130,514,000	9,788,550	93,792,000	10,129,536	124,562,540
Total, 1942	613,382,000	74,219,222	143,860,000	9,638,620	91,086,000	8,470,998	118,552,848

[1] Includes 4 ounces of placer gold in Millard County.

[2] Includes 32 ounces of placer gold distributed as follows: Grand County, 7 ounces; Millard County, 3 ounces; San Juan County, 8 ounces; and Uintah County, 14 ounces.

MINING INDUSTRY

The production of copper ore (96 percent of the State total ore) continued to dominate the mining industry in Utah in 1943. The Bingham district produced ore of all classes, representing 98 percent of the State total. Of the total of 36,532,301 tons of ore produced from mines in the Bingham district, copper ore constituted 99 percent and zinc-lead ore and lead ore nearly all the remainder. The grade of the copper ore was about the same as in 1942, whereas the zinc-lead ore showed a lower lead but a slightly higher zinc content. The bulk of the ore produced from mines in the Park City region was zinc-lead ore, although substantial tonnages of zinc tailings were milled and siliceous tailings were shipped direct to smelters. The ore from the Park City region showed a lowering of the gold, silver, copper, and zinc content compared with 1942. The Tintic district again made a large gain in output of zinc-lead ore, but almost all continued to come from the lower workings of the Chief Consolidated properties. The output of zinc-lead ore from Tooele County was about the same as in 1942. There were substantial decreases in the quantity of high-silica ores shipped direct to smelters in 1943. Much of the output of siliceous ores in 1943 was from mine dumps and tailings piles. The largest declines in siliceous ore output were noted in the Tintic district in Juab and Utah Counties and the Camp Floyd district in Tooele County; however, the Camp Floyd and Tintic continued to supply most of the siliceous ore of the State.

The mining industry in Utah received considerable aid from various Government agencies. The Bureau of Mines gave much engineering assistance to both metal and nonmetal mines in 1943 and in addition assisted materially in the exploration and developing of many properties in the State. The Grazing Service spent over $600,000 on access roads in Utah; however, these roads were not limited to metal mines but were built to serve all classes of mining in the State. The Reconstruction Finance Corporation continued to give financial assistance to mines considered capable of producing needed minerals.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Utah in 1943, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	11	68, 085	16, 992	80, 645	2, 205, 943	76, 548	----------
Dry and siliceous gold-silver ore	30	212, 039	13, 527	705, 077	1, 191, 228	4, 735, 289	----------
Dry and siliceous silver ore	28	72, 351	1, 874	716, 979	804, 398	2, 279, 006	----------
	69	352, 475	32, 393	1, 502, 701	4, 201, 569	7, 090, 843	----------
Copper ore	10	35, 999, 656	310, 242	2, 917, 239	[1] 639, 938, 302	24, 773	----------
Lead ore	31	48, 658	5, 609	532, 911	314, 135	12, 926, 110	----------
Lead-copper ore	4	63	1	768	2, 714	19, 066	----------
Zinc ore	7	[2] 231, 845	34	19, 502	54, 025	1, 565, 008	14, 967, 679
Zinc-lead ore	36	753, 930	42, 184	4, 503, 863	3, 458, 589	108, 854, 932	78, 799, 721
Zinc-lead-copper ore	1	114	3	2, 356	8, 666	33, 268	24, 600
Total, lode mines	[3] 110	37, 386, 731	390, 466	9, 479, 340	[1] 647, 978, 000	130, 514, 000	93, 792, 000
Total, placers	1	----------	4	----------	----------	----------	----------
	111	37, 386, 731	390, 470	9, 479, 340	[1] 647, 978, 000	130, 514, 000	93, 792, 000
Total, 1942	129	34, 981, 655	391, 544	10, 574, 955	[4] 613, 382, 000	143, 860, 000	91, 086, 000

[1] Includes 27,987,429 pounds recovered from mine-water precipitates.

[2] Includes 109,042 tons of zinc slag.

[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

[4] Includes 32,062,916 pounds recovered from mine-water precipitates.

METALLURGIC INDUSTRY

In 1943 Utah mines produced 37,386,731 tons of ore, again exceeding the production for any year in the history of the State. This total was treated as follows: 36,880,347 tons at concentrating mills compared with 34,336,812 tons in 1942; 397,342 tons of ore shipped crude to smelters compared with 460,710 tons in 1942; and 109,042 tons of slag fumed compared with 87,831 tons in 1942. Although most of the crude ore shipped direct to smelters was siliceous and used by the smelters for flux, the State did not produce a large enough quantity of siliceous ore in 1943 to meet the smelter requirements. Most shippers of siliceous dumps and tailings sold their product to the smelters according to the assay content, so that the shipments might be entitled to any premiums allowed by the Government.

Eleven concentrating mills were active in Utah during 1943. Four plants (Arthur, Magna, Ohio Copper, and Tooele) treated 35,996,280 tons of copper ore and old tailings. Four mills (Bauer, Midvale, Silver King, and Tooele), with a combined rated capacity of about 4,000 tons daily, treated 763,967 tons of ore, mostly lead, zinc-lead, zinc-lead-copper, and zinc. One gravity-concentration mill in Tooele County treated 100 tons of silver ore, and one flotation mill in Summit County treated 120,000 tons of old zinc tailings. Three large custom-milling plants—the Midvale concentrator, the Tooele concentrator, and the Bauer concentrator—treated most of the zinc-lead, zinc-lead-copper, lead, and zinc ores milled in Utah in 1943. Most of the feed to the Midvale concentrator came from company-owned mines in the Bingham district, principally the United States & Lark mines. The greatest part of the mill feed in the Bauer mill came from company-owned mines in the Rush Valley and Bingham districts in Utah and the Triumph mine in Idaho. The Tooele concentrator received the larger part of its mill feed from the Park Utah Consolidated property in the Park City region. Aside from the ores treated from mines in Utah, these mills received substantial quantities of ore from mines in California, Nevada, Idaho, Colorado, and Montana. The Tooele concentrator at Tooele, owned and operated by the International Smelting & Refining Co., comprised three sections, each of about 500 tons daily capacity—a copper section, an oxide and zinc-copper section, and a zinc-lead section. The copper section treated copper ores from the National Tunnel & Mines Co. property, the oxide section treated lead ores from the Tintic Standard mine, and the zinc-copper section treated ores principally from mines in California.

Both the Garfield copper smelter at Garfield, operated by the American Smelting & Refining Co., and the Tooele copper smelter at Tooele, operated by the International Smelting & Refining Co., were active throughout 1943. The combined rated capacity of the charge was about 1,900,000 tons. The Garfield smelter had available copper concentrates in excess of its capacity, which was reduced chiefly by a labor shortage; as a result, copper concentrates from Utah were treated at the McGill smelter in Nevada, the Tacoma smelter in Washington, and the El Paso smelter in Texas. Three lead smelters—the Murray plant of the American Smelting & Refining Co., the Midvale plant of the United States Smelting, Refining & Mining Co., and the Tooele plant of the International Smelting & Refining Co.—had a combined rated capacity charge of about 1,330,000 tons. The Murray plant operated intermittently in 1943 and during the latter half of the year began treating considerable ore, concentrates, and residue for the arsenic content. The other two lead smelters were operated continuously during the year. Smelters in Utah received ores, concentrates, and residues, principally from Arizona, California, Idaho, Montana, Nevada, and Colorado, and from Virginia, Missouri, and Illinois.

Mine production of metals in Utah in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Concentrates smelted	1, 277, 578	352, 792	7, 471, 361	615, 295, 416	115, 252, 852	93, 041, 262
Slag fumed	109, 042					
Ore smelted	397, 342	37, 674	2, 007, 979	4, 695, 155	15, 261, 148	750, 738
Mine-water precipitates smelted [1]	16, 572			27, 987, 429		
Placer		4				
		390, 470	9, 479, 340	647, 978, 000	130, 514, 000	93, 792, 000
Total, 1942		391, 544	10, 574, 955	613, 382, 000	143, 860, 000	91, 086, 000

[1] All from Salt Lake County.

Gross metal content of concentrates produced from ores mined in Utah in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Copper	991, 085	310, 214	2, 908, 662	627, 523, 416	899, 254	
Lead	92, 413	18, 096	3, 532, 651	2, 622, 195	102, 936, 803	7, 487, 949
Lead-copper	60	4	3, 177	10, 802	63, 254	4, 098
Zinc	34, 707	3, 701	224, 054	342, 183	1, 972, 298	38, 969, 693
Zinc-lead	46, 288	3, 369	319, 104	824, 260	5, 987, 518	49, 025, 060
Dry iron (from zinc-lead ore)	113, 025	17, 390	477, 046	701, 919	8, 521, 109	6, 545, 752
	1, 277, 578	352, 774	7, 464, 694	632, 024, 775	120, 380, 236	102, 032, 552
Total, 1942	1, 187, 858	338, 510	7, 851, 851	592, 189, 795	119, 638, 909	102, 784, 006

Mine production of metals from concentrating mills in Utah in 1943, in terms of recovered metals

BY COUNTIES

	Ore milled	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	2, 285	759	13	10, 446	42, 500	50, 131	726, 500
Juab	44, 335	10, 627	422	125, 724		2, 646, 220	4, 307, 000
Piute	970	195	43	5, 730	2, 909	74, 303	42, 500
Salt Lake	36, 450, 683	1, 182, 822	331, 713	5, 206, 290	613, 986, 139	69, 035, 465	46, 818, 358
Summit	263, 389	32, 983	1, 722	1, 185, 293	548, 973	22, 497, 933	14, 135, 200
Tooele	40, 343	16, 756	1, 130	225, 051	85, 747	5, 313, 401	3, 995, 204
Utah	12, 451	7, 943	493	73, 711	23, 540	6, 067, 848	392, 000
Wasatch	65, 891	25, 493	17, 238	632, 449	595, 608	8, 094, 351	8, 778, 000
	36, 880, 347	1, 277, 578	352, 774	7, 464, 694	615, 285, 416	113, 779, 652	79, 194, 762
Total, 1942	34, 336, 812	[1] 1, 187, 858	338, 510	7, 851, 851	576, 292, 466	113, 757, 984	79, 365, 500

[1] Includes 7 tons of concentrates yielding 136 ounces gold and 957 ounces silver, from 1,445 tons of ore amalgamated and concentrated.

Mine production of metals from concentrating mills in Utah in 1943, in terms of recovered metals—Continued

BY CLASSES OF CONCENTRATES SMELTED

	Concentrates smelted and recovered metal					
	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
Copper	991,085	310,214	2,908,662	611,806,745	------------	------------
Lead	92,413	18,096	3,532,651	1,851,881	98,818,886	------------
Lead-copper	60	4	3,177	7,308	60,738	------------
Zinc	34,707	3,701	224,054	324,840	1,795,510	35,072,607
Zinc-lead	46,288	3,369	319,104	783,046	5,448,641	44,122,155
Dry iron (from zinc-lead ore)	113,025	17,390	477,046	511,596	7,655,877	------------
	1,277,578	352,774	7,464,694	615,285,416	113,779,652	79,194,762

Gross metal content of Utah crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	68,085	16,992	80,645	2,298,332	115,076	------------
Dry and siliceous gold-silver	212,039	13,527	705,077	1,225,059	7,832,596	------------
Dry and siliceous silver	72,251	1,874	716,947	825,753	3,681,636	------------
Copper	1,376	28	8,577	147,888	41,380	------------
Lead	39,710	5,198	468,057	383,651	8,238,506	------------
Lead-copper	53	1	768	3,255	19,458	------------
Zinc	667	------------	317	2,505	37,243	309,816
Zinc-lead	3,161	54	27,591	53,001	886,549	887,466
	397,342	37,674	2,007,979	4,939,444	20,852,444	1,197,282
Total, 1942	460,710	45,457	2,715,011	5,378,252	36,144,219	705,479

Mine production of metals from Utah crude ore shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	8,351	225	26,949	76,000	229,269	------------
Box Elder	647	6	450	3,000	109,800	119,000
Iron	413	1	90	500	50,400	126,500
Juab	64,262	5,037	394,116	318,100	1,603,980	------------
Millard	291	------------	------------	------------	200	103,500
Piute	213	141	2,640	1,091	2,697	------------
Salt Lake	82,507	11,901	207,120	2,533,632	2,028,935	119,142
San Juan	3	------------	------------	200	------------	------------
Summit	33,303	573	169,477	117,827	1,426,067	59,800
Tooele	58,148	3,204	225,077	224,753	3,526,399	222,796
Utah	148,646	16,559	967,634	1,344,960	6,257,552	------------
Wasatch	367	26	14,336	2,692	25,849	------------
Washington	191	1	90	72,400	------------	------------
	397,342	37,674	2,007,979	4,695,155	15,261,148	750,738
Total, 1942	460,710	45,457	2,715,011	5,019,618	28,388,916	472,200

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	68,085	16,992	80,645	2,205,943	76,548	------------
Dry and siliceous gold-silver	212,039	13,527	705,077	1,191,228	4,735,289	------------
Dry and siliceous silver	72,251	1,874	716,947	804,398	2,273,292	------------
Copper	1,376	28	8,577	144,128	24,773	------------
Lead	39,710	5,198	468,057	300,666	7,254,110	------------
Lead-copper	53	1	768	2,714	19,066	------------
Zinc	667	------------	317	778	31,477	212,379
Zinc-lead	3,161	54	27,591	45,800	846,593	538,359
	397,342	37,674	2,007,979	4,695,155	15,261,148	750,738

Mine production of gold, silver, copper, lead, and zinc in Utah in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated	Gold (lode and placer)[1]	Silver (all lode)	Copper	Lead	Zinc	Total value
	Lode	Placer							
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Beaver County:									
Beaver Lake	1		301	3	83	16,500			$2,309
Pine Grove	1		138	2	405	300	10,400	3,500	1,555
Rocky	2		483	9	824	29,300			4,710
San Francisco	2		7,578	214	26,093	29,900	227,600	3,500	47,380
Star and North Star	1		2,136	10	9,990	42,500	41,400	719,500	93,790
Box Elder County:									
Crater Island	1		31	5	31	1,300			366
Lucin	1		36	1	315	200	6,600		780
Promontory	1		580		104	1,500	103,200	119,000	20,861
Iron County: Indian Peak	1		413	1	90	500	50,400	126,500	17,606
Juab County:									
Detroit	1		43	30	211	2,000			1,460
Fish Springs	3		46	4	4,012	100	24,600		4,851
Mount Nebo	1		2		7		400		35
Spring Creek	1		11		21	700	1,800		241
Tintic[2]	8		108,443	5,425	515,423	315,300	4,220,600	4,293,000	1,377,576
Trout Creek	1		52		166		2,800	14,000	1,840
Millard County: House Mountain or Notch Peak	1	1	291	[3] 4			200	103,500	11,333
Piute County:									
Mount Baldy	1		161	124	2,368	1,000	2,000		6,304
Ohio	2		1,022	60	6,002	3,000	75,000	42,500	16,973
Salt Lake County:									
Big Cottonwood	5		565	28	6,120	2,600	149,000	128,000	30,669
Little Cottonwood	1		229	18	1,589	7,300	18,600		4,104
Smelter	3		95	17	1,336	2,200	23,200		3,571
West Mountain	14		36,532,301	343,551	5,404,365	644,495,100	70,873,600	46,809,500	110,022,698
San Juan County: La Sal	1		3			200			26
Summit County: Uintah	11		296,692	2,295	1,354,770	666,800	23,924,000	14,195,000	4,457,761
Tooele County:									
Camp Floyd	3		41,733	2,529	68,317				137,096
Clifton	1		1,363		3,292	600	29,800		4,654
Dugway	1		489	2	675	500	78,600	42,500	11,100
Free Coinage	1		10		59		2,200	2,000	423
Lakeside	2		527	2	329	900	122,200		9,586
North Tintic	1		35	1	62		3,600	5,500	943
Ophir	8		12,185	129	146,627	231,400	2,921,400	254,500	385,456
Rush Valley	6		150,907	1,273	235,295	86,200	7,010,200	17,760,000	2,666,927
Willow Springs	1		284	416	2,139	900	145,000		27,073
Utah County:									
American Fork	4		429	7	1,779	2,100	24,000	25,500	6,337
Tintic[2]	12		160,668	17,045	1,039,566	1,366,400	12,301,400	366,500	2,475,641
Wasatch County:									
Blue Ledge	2		393	29	14,431	2,900	30,200	5,000	14,459
Snake Creek	2		65,865	17,235	632,354	595,400	8,090,000	8,773,000	2,684,535
Washington County: Tutsagubet	1		191	1	90	72,400			9,511
Total Utah	110	1	37,386,731	390,470	9,479,340	647,978,000	130,514,000	93,792,000	124,562,540

[1] All lode except 4 ounces from a placer in Millard County.

[2] Tintic district lies in both Juab and Utah Counties.

[3] All placer.

BEAVER COUNTY

Beaver Lake district.—Lessees operated the O.K. mine from February 1 to November 1, 1943, and shipped crude copper ore and crude siliceous ore direct to smelters.

Pine Grove district.—The Wah Wah Mining Co. operated its property from March 1 through December 1943. During the period of operation the company shipped 138 tons of ore, comprising 47 tons of zinc-lead ore to the Tooele concentrator and 91 tons of siliceous ore to smelters. Considerable aid was afforded the company in its development program by various Government agencies. The Reconstruction Finance Corporation made available a loan of $20,000; the Grazing Service built several miles of access roads; and the Bureau of Mines did considerable development on the property, including 145 feet of drifting and 200 feet of diamond drilling. As a net result of the aid received, the company reports that ore reserves exposed include 38,500 tons of oxide zinc ore, 8,000 tons of zinc-lead sulfide ore, and 20,000 tons of oxidized silver-lead ore.

Rocky district.—Lessees operated the Montreal and Old Hickory group in 1943 and shipped 483 tons of crude copper ore direct to Garfield.

San Francisco district.—Hall Bros. Co., Inc., operated the dump of the Horn Silver mine under lease from January 1 to April 29, 1943. During the period of operation, 5,946 tons of crude gold-silver dump ore were shipped direct to Garfield and 102 tons of zinc-lead ore to the Bauer mill; in addition, A. E. Kipps shipped 1,116 tons of gold-silver dump ore to Garfield. The branch railroad line connecting Frisco with Milford was abandoned and the tracks were removed in July. A lessee shipped crude lead ore and crude silver ore direct to smelters from the Quad Metals dump.

Star and North Star district.—Lessees operated the Moscow Silver Mines Co. property in 1943 and shipped 2,136 tons of rich zinc ore to the Bauer mill.

BOX ELDER COUNTY

Crater Island district.—A small lot of gold-copper ore was shipped direct to Garfield from the Copper Blossom mine in 1943.

Lucin district.—Some crude lead ore was shipped to Murray from the Copper Mountain mine in 1943.

Promontory district.—Crude oxidized zinc-lead ore was shipped to the Tooele lead plant from the Lake View Carbonate mine by the Lakeview Mining Co. in 1943.

IRON COUNTY

Indian Peak district.—The New Arrowhead Mining Co. operated its property from March 16 to December 31, 1943, and shipped zinc-lead and zinc ores to the Tooele lead plant and Tooele slag-fuming plant. The company received a Reconstruction Finance Corporation loan for $15,000 in 1943 for the purpose of developing its property. The Federal Grazing Service built an access road to the property.

JUAB COUNTY

Detroit district.—The Detroit district lies in both Juab and Millard Counties, but in 1943 all the output came from the Juab County section and was crude gold ore shipped to Garfield from the Copperhead mine.

Fish Springs district.—Crude lead ore shipped to smelters from the Utah Mines group, Black Dragon, and Mill John mines comprised the output from the Fish Springs district in 1943.

Mount Nebo district.—A test lot of crude lead ore was shipped to Murray from the Central Sultana mine in 1943.

Spring Creek district.—A small lot of lead-copper ore was shipped direct to a smelter from the New Premier mine in 1943.

Tintic district.—The Tintic district, which lies in both Juab and Utah Counties, is reviewed here. The table that follows gives the metal production in each section of the district in 1943, a comparison with the total in 1942, and the grand total from 1869 to 1943.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah Counties, Utah, 1942–43, and total, 1869–1943, in terms of recovered metals

	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
1943		*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Juab County	8	108, 443	5, 425	515, 423	315, 300	4, 220, 600	4, 293, 000	$1, 377, 576
Utah County	12	160, 668	17, 045	1, 039, 566	1, 366, 400	12, 301, 400	366, 500	2, 475, 641
	20	269, 111	22, 470	1, 554, 989	1, 681, 700	16, 522, 000	4, 659, 500	3, 853, 217
Total, 1942	24	337, 140	23, 819	2, 059, 193	1, 706, 700	20, 351, 500	3, 415, 900	4, 185, 720
Total, 1869–1943	-------	(1)	2, 544, 621	257, 039, 356	240, 310, 864	1, 834, 886, 379	48, 821, 138	384, 632, 532

[1] Figures not available.

During 1943, as in previous years, the Tintic district was the principal source of highly siliceous ores that are used both as reverberatory and convertor flux at the copper smelters in the Salt Lake Valley. The elimination of considerable siliceous ores through the closing of some properties and greater emphasis on the mining of zinc-lead ores by others has caused some concern at the copper smelters.

In 1943 the Chief Consolidated Mining Co. operated the Chief No. 1, Gemini, Eureka Hill, and Plutus mines in Juab County on company and lessee account. The company operations were almost entirely in the Chief No. 1 mine, and the lessees were active in the Gemini, Eureka Hill, and Plutus mines. Although the bulk of the ore produced from the Chief No. 1 mine was zinc-lead and came from the dewatered area between the 1,800- and 2,100-foot levels, substantial quantities of siliceous ores were mined and shipped direct to Garfield. Production from the Gemini and Plutus mines was less than in 1942, but that from the Eureka Hill mine was about the same; all three properties produced crude siliceous ores, which were shipped direct to Garfield. The output of zinc-lead ores from the Chief No. 1 mine was considerably greater than in 1942, and all was shipped to the Bauer custom mill. The production in 1943 comprised 45,141 tons of zinc-lead ore, 11,000 tons of siliceous ore, and 834 tons of silver-lead ore from the Chief No. 1 mine; 4,060 tons of siliceous ore and 370 tons of silver-lead ore from the Gemini mine; 211 tons of siliceous ore from the Eureka Hill mine; and 192 tons of siliceous ore from the Plutus mine—an aggregate of 61,808 tons of ore of all classes containing 1,499 ounces of gold, 232,727 ounces of silver, 47,491 pounds of copper, 4,627,441 pounds of lead, and 6,226,241 pounds of zinc. According to the company printed annual report for the year ended December 31, 1943, development footage was increased in the lower levels of the Chief No. 1 mine over that of 1942, the most important piece of work in this regard being a drift connection on the 1,800-foot level, just completed, to an objective known as the "Gemini sink." The purpose of this drift, aside from its geological possibilities, is to carry the water to this Gemini sink, transferring it from its present course on the 1,600-foot level, thus saving a lift of some 200 feet with a compensating saving in power costs alone of approximately $2,000 per month. The company has been pumping an average of 3,300 gallons per minute continuously during 1943; the water has been lowered 250 feet from its former level and is, as of March 1, 1944, 80 feet above the 2,200-foot level. The company's objective in this operation is to dewater to its present lowest (2,500-foot) level.

The company states further that there are six ore runs making below the water level. Years ago, these were mined selectively for the lead only; however, there are sections of these runs in which even selective mining of lead was discontinued owing to the then-existing low metal prices. These latter areas are now affording the company its greatest tonnage of zinc-lead ores. In addition to the extraction of ores from these particular areas, mining will be carried on from the faces of the various ore runs as each becomes dewatered and will be followed down into virgin territory because there is no doubt that these ores continue to greater depths. The mining of zinc-lead ores from the present levels is economic only because of the premiums for zinc and lead allowed by the Government, but when mining again is taken up on the faces of the six ore runs mentioned above, from the bottom levels, it will again be possible to mine selectively and thus materially increase the grade of the ores. The beginning of selective mining will depend on the speed of the final dewatering operation, and the company has equipment on hand to increase the present pumping capacity to 5,000 gallons per minute.

The Eagle & Blue Bell, Centennial-Beck, and Victoria mines, all owned or controlled by the United States Smelting, Refining & Mining Co., were operated until August 31, when all operations stopped. The production from these properties comprised 14,026 tons of siliceous gold-silver ores, all shipped direct to smelters, principally Garfield. A total of 30,478 tons of siliceous gold-silver ore from the Mammoth mine and dump was shipped direct to Garfield. Philip P. Clark operated the Godiva mine under lease throughout 1943 and shipped 2,002 tons of high-grade silver ore and 61 tons of lead ore direct to smelters. A car of crude silver ore was shipped direct to a smelter from the Empire group in 1943; the property was operated from September through December by a lessee. The remainder of the output from the Juab County section of the Tintic district was a few tons of siliceous tailings shipped direct to smelters.

The major part of the metal output of the Utah County section of the Tintic district was contained in ores produced by the Tintic Standard Mining Co. and its subsidiary companies. The following operating details are taken in part from the company printed annual report for the year ended December 31, 1943. Ore produced by the Tintic Standard mines (including the Hannibal Unit and Iron Blossom mine) totaled 58,705 tons, or 20,193 tons less than in 1942. Reductions were noted in the output of both lead ore and siliceous ore. The number of men employed underground during 1943 was at all times less than that required to operate advantageously. The men were not available from any source, although some help was given by various Government agencies. The War Production Board changed the premium payments for lead from the Tintic Standard mine, effective August 1, 1943, eliminating the B premium payments and changing A premium payments from zero quota to 230 tons a month. The Eureka Lilly mines were operated only by lessees in 1943; production amounted to 9,387 tons of siliceous ore shipped direct to smelters, which includes 48 tons produced in course of development by the Tintic Standard-North Lily Development Unit. The Colorado Consolidated Mines Co. property was operated principally on lessee account in 1943. The No. 1 shaft on the Colorado Consolidated property was repaired, and a hoist and compressor were installed preparatory to increased mining operations. The Federal Government, through its Grazing Service, has started to construct a road that will, when completed, make it possible to connect the 300-foot level of the No. 1 shaft with the surface by a short tunnel. Production in 1943 totaled 4,651 tons of siliceous ore, all shipped direct to smelters.

Development of the area owned by the Eureka Lilly Consolidated Mining Co. and the Twentieth Century Mining Co. was continued in 1943 by the Tintic Standard Mining Co.-North Lily Mining Co. Development Unit. The Development Unit is the result of, and in accordance with, a joint development program undertaken by the Tintic Standard Mining Co. and the North Lily Mining Co. under terms of an agreement dated October 29, 1942. A vein of ore approximately 3 feet wide was found within the Twentieth Century property, and development is continuing on it. Production in 1943 amounted to 48 tons of siliceous ore from the Eureka Lilly section and 553 tons of siliceous ore from the Twentieth Century section. Development in 1943 totaled 1,412 feet of drifts, 115 feet of raises, 1,584 feet of diamond drilling, and 272 feet of long-hole drilling. Development on all other properties of the Tintic Standard Mining Co. in 1943 consisted of 2,305 feet of drifts, 241 feet of raises, 66 feet of shafts, 102 feet of diamond drilling, and 3,061 feet of long-hole drilling.

An aggregate of 73,296 tons of ore of all classes was mined in 1943 by the Tintic Standard Mining Co. and its subsidiary companies and lessees, including the Development Unit. The total metal content was 3,567 ounces of gold, 750,404 ounces of silver, 1,042,974 pounds of copper, 11,521,686 pounds of lead, and 67,557 pounds of zinc. A considerable quantity of the lead ore from the Tintic Standard mine was milled at the Tooele concentrator, making a lead concentrate and a siliceous tailing. The purpose served by milling this lead ore was to eliminate much of the silver from the lead blast-furnace charge. The American Smelting & Refining Co. continued to ship siliceous gold-silver ore from the Harold dump of the Tintic Standard Mining Co. direct to Garfield in 1943; 71,779 tons of such material were shipped. The Tintic Standard Mining Co. receives a flat price per ton of material sold from the dump. It is estimated that the dump will be virtually exhausted in about 1 year if shipments continue at the present rate. The Tintic Bullion mine owned by the International Smelting & Refining Co. was operated throughout 1943 by the North Lily Mining Co.; production included 2,073 tons of high-grade gold ore (some of which was exceptionally rich), 1,019 tons of gold-silver ore, and 2,821 tons of zinc-lead ore. Other active mines in the Utah County section of the Tintic district, owned or controlled by the International Smelting & Refining Co., included the Eureka

Bullion, May Day, and North Lily properties; production comprised 3,066 tons of gold ore, 326 tons of silver ore, 185 tons of gold-silver ore, and 202 tons of lead ore, all shipped direct to smelters.

Trout Creek district.—The Trout Creek Mining Co. shipped a car of zinc-lead ore to the Combined Metals Reduction Co. plant at Bauer in 1943.

MILLARD COUNTY

Notch Peak district (formerly Kanosh).—The Kanosh Leasing Co. operated the Blue Bell mine from May 7 to October 8, 1943. During the operating period 291 tons of oxidized zinc ore were shipped direct to the Tooele slag-fuming plant; production at the mine was limited to amounts acceptable by the smelter for use as direct feed in its slag plant.

PIUTE COUNTY

Mount Baldy district.—John Pearson, lessee, operated the Deer Trail mine in January 1943 and shipped 161 tons of gold-silver ore direct to Garfield.

Ohio district.—The Cascade Lease operated the Cascade claim throughout 1943 and shipped 46 tons of crude gold-silver ore direct to Garfield and 970 tons of zinc-lead ore to the Midvale concentrator. A test lot of gold ore was shipped direct to a smelter from the Cedar Hills property.

SALT LAKE COUNTY

Big and Little Cottonwood districts.—Crude lead and zinc-lead ore shipped direct to smelters from the Cardiff mine by lessees in 1943 comprised the bulk of the output from the Big Cottonwood district. Other producers active in 1943 included the Kentucky Utah Mining Co., Mountain Mines Co., American Metal Mining Co., and R. G. Shaw.

Silver ore and lead ore shipped direct to smelters comprised the production from the Little Cottonwood district in 1943.

Smelter district.—Production from the Smelter district in 1943 came from the Sandy smelter dump, Mingo smelter dump, and cleanings at local assay offices, railroad yards, and sampling company yards.

West Mountain (Bingham) district.—The Bingham district, by far the most important mining region in Utah, produced 88 percent of the gold, 57 percent of the silver, virtually all the copper, 54 percent of the lead, and 50 percent of the zinc output of the State in 1943. The total value of metal output in the district reached a new high and easily surpassed that of any other district in the United States. The following table shows production from mines in the district in 1942 and 1943 and the total from 1865 to 1943.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Salt Lake County, Utah, 1942–43, and total, 1865–1943, in terms of recovered metals

Year	Mines producing	Ore	Gold (lode and placer)	Silver (lode and placer)	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1942	15	34,087,179	327,258	5,399,744	609,374,900	79,991,300	45,267,100	$98,597,468
1943	14	36,532,301	343,551	5,404,365	644,495,100	70,873,600	46,809,500	110,022,698
Total, 1865–1943	....	(1)	5,141,736	132,794,634	[2] 4,052,854	[2] 1,495,795	[2] 438,283	1,576,356,205

[1] Figures not available.

[2] Short tons.

The Utah Copper Co. exceeded its previous record production and in 1943 easily maintained its position as the leading copper producer in the world. The company produced over three-quarters of the State gold, one-third of the State silver, and virtually the entire State output of copper. Labor shortages, which hindered maximum output from most mines in Utah, did not result in any reduction in the tonnage of ore mined in the huge open-pit operation at Bingham. Ore and waste were mined at the rate of approximately 218,000 tons a day in 1943 compared with 204,000 tons in 1942. The ore was hauled to the two company concentrating units at Magna and Arthur, approximately 17.5 miles by rail from the pit. The waste rock was placed in gulches adjacent to the pit and there leached. New equipment, which pertained mostly to ore haulage, comprised two large Mallet-type steam locomotives, three Diesel-type locomotives, 100 ore cars of 100-ton capacity, and 25 forty-cubic yard dump cars for use in stripping. Ore was milled at the Magna and Arthur plants at the rate of about 97,000 tons a day in 1943 compared with 91,000 tons in 1942; the plants were shut down for two brief periods of about 48 hours in 1943 as a result of labor disputes. The average grade of the ore treated in 1943, compared with 1942, was about the same in copper and gold, slightly lower in silver, but slightly higher in molybdenite. Average mill recoveries were somewhat lower in gold and copper but slightly higher in silver. The output of molybdenum sulfide was greater than in 1942, but the average mill recoveries were lower. A new power plant was nearly completed in 1943.

The printed annual report of the Kennecott Copper Corporation for the year ended December 31, 1943, says that the central power station, after suffering combined construction delays due to difficulties in obtaining labor and in securing delivery of the necessary control and metering equipment and high-pressure piping, was finally placed in full operation at the end of February 1944. A new smelting contract, made effective with the Garfield smelter in 1943, resulted in a material gross saving in the cost of smelting. The contract is for a 10-year period.

In addition to the huge quantity of copper contained in the copper concentrates made at Magna and Arthur, the company—by leaching its waste dump—produced copper precipitates in 1943 which contained over 28,000,000 pounds of copper, a reduction of about 3,000,000 pounds compared with 1942. The precipitating plant is situated at Lead Mine, a few miles below the town of Bingham.

Owing to the vast quantities of ore treated the company was the leading copper and gold producer in the United States in 1943, second in production of molybdenum, and high among the leading silver producers.

An adit large enough to accommodate a standard railroad locomotive was started just below the town of Bingham in 1943. The adit, nearly half completed as of May 1943, will be approximately 4,400 feet long when completed and will end under the floor of the present open pit some 50 feet below the surface. The adit is to be completed in 1944 and will be used for ore haulage.

According to records received during the first 4 months of 1944, the company has cut back slightly its previous high rate of production.

The Boston Consolidated mine, owned by the Utah Copper Co., was operated all of 1943 by the American Smelting & Refining Co.

under lease agreement. Crude ore was shipped direct to the Garfield and Murray smelters and exceeded the output in 1942 by about 10,000 tons. The copper content of the ore shipped was slightly lower than in 1942.

Zinc and lead production of the Bingham district came largely from the United States & Lark property of the United States Smelting, Refining & Mining Co. Production of lead in 1943 declined more than 9,000,000 pounds, whereas that of zinc increased over 1,500,000 pounds. These fluctuations were a direct result of similar loss in lead production and of gains in zinc production at the United States & Lark property. The company mined and shipped to its Midvale concentrator about the same quantity of zinc-lead ore as in 1942; however, the gold, silver, copper, and lead content showed a decrease, but the zinc content was somewhat greater. The output of crude gold-silver and lead ores shipped direct to smelters amounted to about 22,500 tons. The mine retained its position as leading lead producer and second-largest zinc producer in the Western States. Its gold and silver output was exceeded by that of the Utah Copper Co. Development in 1943 was somewhat greater than in 1942 and comprised 19,987 feet of drifts and raises and 5,621 feet of diamond drilling completed. Other properties in the Bingham district owned or controlled by the United States Smelting, Refining & Mining Co. and active in 1943 included the Niagara, the Montana-Bingham Consolidated, and the Utah Metal. Production in 1943 comprised 13,477 tons of zinc-lead mill ore and 1,976 tons of crude ore of all classes shipped direct to smelters.

The Apex-Delaware group was operated throughout 1943 by the National Tunnel & Mines Co. The property, operated through the 5-mile Elton tunnel which starts in Tooele, produced ore of several classes. Production was substantially larger than in 1942 owing to completion of rehabilitation and clean-up work and to connection with the Utah Apex and Utah Delaware mines in Bingham. Over 152,000 tons of copper ore (all sulfide) were milled in 1943; in addition nearly 17,000 tons of zinc-lead ore were treated at the Tooele sulfide concentrator, and 55 tons of ore were sent direct to a smelter. All ore was treated at the plants of the International Smelting & Refining Co. at Tooele, only a short distance from the portal of the Elton tunnel.

The Ohio Copper Co. treated about 469,747 tons of old flotation- and gravity-mill tails, averaging about 8 pounds of copper to the ton, in its 1,500-ton flotation mill. Production amounted to 5,383 tons of copper concentrates and 257 tons of copper precipitates. The rate of production (1,305 tons per day) was considerably greater than in 1942, and operations were continuous throughout 1943 except for brief periods of shut-down caused by breakage in tailings dams. It is estimated that the tailings piles remaining at Lark will provide material for 6 more years of operation at the rate of 1,500 tons a day.

The Butterfield group, including the Queen property, was operated continuously by the Combined Metals Reduction Co. and lessees in 1943. Production was 27,319 tons of zinc-lead mill ore and 1,581 tons of siliceous ores. The mill ore was treated at the Bauer plant of the Combined Metals Reduction Co., and the siliceous ores were shipped direct to smelters.

Other producers active in the Bingham district in 1943 included the Kaign, New England, Chicago Silver, property of the Bingham Lead Co., and the Kremlin mines.

SAN JUAN COUNTY

The only production in San Juan County in 1943 was a small lot of copper ore shipped direct to a smelter from the Hope claim in the La Sal Mountains.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

The Park City region includes the Uintah district in Summit County and the Blue Ledge and Snake Creek districts in Wasatch County. Mines in the Park City region produced a greater tonnage of material than in 1942; however, much of the increase in total tonnage was old tailings from Silver Creek, which were shipped under favorable premiums for lead direct to smelters for flux and also reconcentrated for zinc and lead. The production of all metals except lead decreased, as indicated in the following table which gives the output from the region in 1942 and 1943 and the total since 1870.

Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, Utah, 1942–43, and total, 1870–1943, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1942	15	279, 748	22, 935	2, 632, 109	1, 454, 700	30, 556, 800	28, 051, 700	$7, 320, 580
1943	15	362, 950	19, 559	2, 001, 555	1, 265, 100	32, 044, 200	22, 973, 000	7, 156, 755
Total, 1870–1943		(1)	515, 879	231, 301, 798	66, 047, 313	2, 350, 547, 834	634, 077, 611	351, 356, 903

[1] Figures not available.

The total tonnage of ore mined and treated by the Silver King Coalition Mines Co. in its 800-ton flotation mill exceeded that in 1942 by 5,000 tons; however, the gold, silver, copper, and zinc content of the ore treated was substantially lower than in 1942, whereas the lead content remained about the same. Both development and production were handicapped throughout the year as a result of manpower shortages so marked as to seriously upset operational balance. The War Production Board again modified the company quota on zinc, to zero from a former quota of 125 tons; the basic lead quota remained unchanged at 150 tons. The mine and 800-ton concentrator were active 308 days in all during 1943 and treated an average of 311 tons daily. The company printed annual report for the year ended December 31, 1943, states that mining produced a total of 96,018 tons, of which 95,800 tons were milled and 218 tons shipped direct to a smelter. The 95,800 tons of zinc-lead ore milled made 9,895 tons of lead concentrates and 6,079 tons of zinc concentrates; the total metal content of the concentrates was 1,079 ounces of gold, 804,274 ounces of silver, 446,925 pounds of copper, 13,294,454 pounds of lead, and 7,603,562 pounds of zinc. The lead concentrates averaged 78.3 percent lead and were shipped to the Murray smelter; the zinc concentrates averaged 61.7 percent zinc and were shipped to the Anaconda Copper Mining Co. zinc smelter at Anaconda, Mont. The crude ore shipped direct to a smelter contained 15 ounces of gold, 12,346 ounces of silver, 4,710 pounds of copper, and 132,126 pounds of lead. Total development footage completed in 1943 was less than in 1942 and included 17,428 feet of drifts, 2,928 feet of raises, winzes, and shafts, and 155 feet of diamond drilling.

The Park Utah Consolidated Mines Co. operated the Park Utah Consolidated Mines group in Summit County and the Park Utah Consolidated Mines group in Wasatch County in 1943. The boundary line between Summit and Wasatch Counties passes over the property of the company. All the ore produced was sent to the plants of the International Smelting & Refining Co. at Tooele for further treatment. According to the company printed annual report for the year ended December 31, 1943, the production from the property for the year was 49,783 tons of ore containing 912 ounces of gold, 447,331 ounces of silver, 257,701 pounds of copper, 11,456,219 pounds of lead, and 9,324,629 pounds of zinc. The ore mined had a lower gold content, higher silver and lead content, and about the same zinc content as in 1942. The production was lower than in 1942, owing chiefly to a shortage of efficient labor and to other general operational difficulties. Early in 1943 a favorable modification in the premium allowance for metals by the Government enabled the company to undertake unwatering of the lower levels of the Ontario mine, which had been flooded for over 20 years, and to unwater the lower levels of the Eastern section of the property for the development of new zinc production.

Over 7,000 feet of tunnels and shafts were reopened, repaired, and equipped for operations. The unwatering, although an extensive project, proceeded smoothly, and the first objectives of the operation have been reached and are under production; further major development and exploration are now under way. About 5,000 gallons of water per minute are being pumped; reserve capacity is available if needed. Further favorable results should be obtained if future conditions are such that an intensive development program can be maintained. The Park City Utah Mines group (Keetley) in Wasatch County shipped 347 tons of ore of all classes to the International smelter and mill for treatment. All ore shipped in 1943 from the Daly group was mined by the Park Utah Consolidated Mines Co.; it comprised 2,142 tons of silver ore shipped direct to the International smelter. In addition, about 9,000 tons of siliceous silver ore from the Ontario and Daly dumps were shipped direct to smelters.

The New Park Mining Co. production in 1943 was the greatest yet reached by the company and resulted in its being the leading producer of gold, zinc, and copper in the Park City region. Gold-silver-copper-lead-zinc ore amounted to 65,811 tons, which contained 19,892 ounces of gold, 690,385 ounces of silver, 873,734 pounds of copper, 8,915,097 pounds of lead, and 12,083,216 pounds of zinc. All ore was shipped to the Midvale concentrator for further treatment. The company received during 1943 the original quota payments from the War Production Board under an A quota basis; premium payments in 1943 totaled $376,348. According to the company printed annual report for the year ended December 31, 1943, the policy of the company has been to keep the development well ahead of production, and at present there is blocked out enough ore to last at least 1½ years at the present rate of production. The company has retained in the mine stopes showing high gold and silver values. Further, these values have increased consistently with depth and should assure a valuable reserve for the company. The gold appears to be primary in origin and may continue to great depth. New methods of mining were introduced during 1943 to utilize to the maximum the limited manpower available, and a system of horizontal cut and fill stopes was introduced using electric scrapper hoist. This resulted in materially reducing costs in mining and conserved considerable manpower. The main workings of the company were driven to the West under ore which showed 800 feet above in the Star of Utah tunnel. Good progress was made, and the indications are very favorable for opening up an entirely new ore body several thousand feet to the West of the company's present workings. Exploratory work was also progressing on the Park Galena-Mayflower fissure to the East of the present workings. The Park-Mayflower tunnel now parallels this fissure for 8,000 feet before it enters the fissure of the Park-Galena ore body. An agreement was made with the United States Smelting, Refining & Mining Co. providing for vertical lines between the properties of the two companies. This will avoid the danger of apex suits between the companies and is particularly important because of the great depth at which the company is developing below the surface and the difficulty of knowing where fissures outcrop.

Reuben Garbett treated over 100,000 tons of old tailings in a flotation mill in Park City and produced about 600 tons of zinc middlings, which were shipped to the Midvale concentrator for further treatment.

A total of over 16,000 tons of old tailings from various claims along Silver Creek was shipped direct to smelters, principally Garfield. These tailings contained a small quantity of silver and lead and were mined only because of the premiums granted by the War Production Board. The Board concluded these tailings were one source of siliceous material available to the smelters at the lowest expenditure of manpower.

Other production in the Park City region in 1943 included silver ore from the Quincy mine and zinc-lead ore from the Park City Unit and American Flag mines.

TOOELE COUNTY

Tooele County in 1943 again ranked fourth among the metal-producing areas in Utah. Mines in the county produced gold, silver, copper, lead, and zinc valued at $3,243,258 compared with $3,179,414 in 1942.

Camp Floyd district.—Siliceous gold and gold-silver ores, all shipped direct to Garfield, from the Geyser Marion, Brickyard, and Sacramento mines comprised the output from the Camp Floyd district in 1943. The Brickyard mine was closed in April 1943, but the other two properties were active throughout the year. The War Production Board granted exception to its L-208 order in the case of these properties, as they are one of the two chief sources in Utah of ores with a high silica content.

Clifton district.—Some silver ore was shipped direct to a smelter in 1943 from the Western Utah Copper property.

Dugway district.—Some zinc-lead ore was shipped to the Bauer and International concentrators in 1943 from the Smelter Canyon mine.

Free Coinage district.—A test lot of zinc-lead ore was shipped direct to a smelter in 1943 from the Lead Queen mine.

Lakeside district.—Lead ore shipped direct to a smelter from the Monarch mines and silver ore concentrated from the Georgia Lyn mine comprised the output from the Lakeside district in 1943.

North Tintic district.—A car of zinc-lead ore from the New Bullion mine was shipped direct to the International lead smelter in 1943.

Ophir district.—The Hidden Treasure mine, operated throughout 1943 by the United States Smelting, Refining & Mining Co., was the largest producer in the Ophir district; it produced 7,629 tons of ore of all classes, a gain of over 1,100 tons compared with 1942. The Ophir Development Co. operated its Ophir Hill mine all of 1943, producing 987 tons of zinc-lead ore and 1,354 tons of silver ore. Among other properties active in 1943 were the Shoo Fly, Togo claim, Wandering Jew, and Mono group.

Rush Valley district.—Production from the Rush Valley district in 1943, as in former years, came mostly from the West Calumet (Calumet) mine owned and operated by the Combined Metals Reduction Co. The mine produced, on both company and lessee accounts, 38,881 tons of zinc-lead ore milled at the Bauer plant and 213 tons of crude lead ore shipped direct to a smelter. A total of 1,826 tons of ore of all classes was shipped direct to smelters from the Honerine-Galena King mine. Other production in 1943 came chiefly from the Bluestone and Silver Eagle mines.

Smelter district.—The second-largest source of zinc production in Utah in 1943 was zinc slag fumed at the International Smelting & Refining Co. plant at Tooele. The plant was operated continuously in 1943 and treated a total of 140,165 tons of cold slag, hot slag, and crude ore and produced a greater quantity of zinc and lead than in any previous year of operation. Although the plant treated 140,165 tons of material, only 109,042 tons of this total and the zinc and lead contained are credited to Utah; the remainder is slag derived from the smelting of ores and concentrates from mines in other States and is therefore credited to those States. Recovery of zinc at the slag-fuming plant was somewhat higher than in 1942 because the lead recovery at the lead blast furnace was exceptionally high owing to the fact that the lead blast furnace and slag-fuming plant are in closed circuit. The zinc fume produced averaged 72 percent zinc and the lead fume 47 percent lead.

Willow Springs district.—The Oro Del Rey mine, only active producer in the Willow Springs district in 1943, shipped 284 tons of rich gold-silver-lead ore direct to smelters. The property was operated by the owners and lessees.

UTAH COUNTY

American Fork district.—The Howell Mining Co. operated the Globe mine from March through December and the Live Yankee mine intermittently in 1943. A total of 109 tons of gold-silver ore was shipped direct to smelters and 267 tons of zinc-lead ore to custom mills. Most of the remaining production was zinc-lead ore from the Silver Dipper mine.

Tintic district.—Mines in the Utah County section of the Tintic district are reviewed under Juab County.

WASHINGTON COUNTY

Tutsagubet district.—The Apex Mining Co. operated its Apex mine from January to April 30, 1943, and shipped copper ore direct to Garfield.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON

(MINE REPORT)

By G. E. Woodward and Paul Luff

SUMMARY OUTLINE

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SUMMARY

Washington mines yielded gold, silver, copper, lead, and zinc valued, in terms of recoverable metals, at $7,838,012 in 1943 compared with $8,172,609 in 1942; the output of silver and lead showed slight gains, whereas the output of each of the other metals decreased. The average prices paid for copper, lead, and zinc were considerably higher than in 1942, which tended to maintain a total value of metal output about equivalent to that in 1942. The decrease in gold output in 1943 was caused by the closing of nearly all the gold mines in the State. As in former years, copper was derived almost entirely from the Holden property of the Howe Sound Co. in Chelan County; although the tonnage of ore treated was greater than in 1942, it had a lower copper, gold, silver, and zinc content. The decreased production of zinc and the gain in output of lead was the net result of the treatment of a smaller tonnage of zinc-lead ore in Pend Oreille County, having a lower zinc but a higher lead content than in 1942. The Pend Oreille Mines & Metals Co. was again the leading producer of both lead and zinc in the State.

Shortages of labor prevailed throughout the principal copper-, lead-, and zinc-producing areas and were particularly acute during the summer months. The Army again furloughed about 100 soldiers to the copper property in Chelan County and the zinc-lead mines in Pend Oreille County.

The War Production Board took steps during the last quarter of 1943 to curtail the development of copper, lead, and zinc mines. The main features of the action, effective October 27, were that premiums in the B range for lead and the B and C ranges for zinc were denied to lead or zinc mines not already operating and to lead and zinc mines having a low rate of productivity and in areas in which there is a serious labor shortage. The Government will not finance new zinc projects. Effective November 9, the Board stated that no more applications for the special copper premium price would be received after December 31, 1943. These actions were prompted by increased mineral production, success in balancing supplies with requirements of the armed services and the most essential civilian needs, and a greater need for marginal manpower than marginal production.

The Geological Survey and the Bureau of Mines were active in promoting the availability of mineral production from several properties in Washington. The services rendered comprised engineering assistance to operators, as well as the performance of actual development work by core drilling and other mining methods. Large tonnages of ore were developed and reserves proved through the joint work of the Bureau of Mines, the Geological Survey, and the mining companies.

The Department of Agriculture, operating through its Forest Service, rendered much service to various base-metal mines in the State by building access roads.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold[1]	Silver[2]	Copper[3]	Lead[3]	Zinc[3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787. [5] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Washington, 1939–43, and total, 1860–1943, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1939	88	84	1,124,564	90,420	$3,164,700	442,063	$300,067
1940	83	88	1,166,798	82,136	2,874,760	365,175	259,680
1941	61	56	1,238,509	84,176	2,946,160	402,030	285,888
1942	37	18	1,222,937	75,396	2,638,860	369,038	262,427
1943	24	2	1,131,281	65,244	2,283,540	370,440	263,424
1860–1943			(1)	2,022,365	49,538,098	11,962,368	8,466,998

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1939	17,996,000	$1,871,584	7,436,000	$349,492	20,262,000	$1,053,624	$6,739,467
1940	19,224,000	2,172,312	5,110,000	255,500	23,120,000	1,456,560	7,018,812
1941	17,372,000	2,049,896	7,806,000	444,942	28,640,000	2,148,000	7,874,886
1942	16,060,000	1,943,260	9,702,000	650,034	28,796,000	2,678,028	8,172,609
1943	14,630,000	1,901,900	10,044,000	753,300	24,406,000	2,635,848	7,838,012
1860–1943	[2] 62,409	15,996,461	[2] 63,149	7,909,914	[2] 102,889	14,210,870	96,122,341

[1] 1860–1903: Figures not available; 1904–43: 9,518,491 tons produced.

[2] Short tons.

Gold and silver produced at placer mines in Washington, 1939–43, in terms of recovered metals

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1939	2,261	$79,135	358	$243	$79,378
1940	2,747	96,145	720	512	96,657
1941	540	18,900	90	64	18,964
1942	356	12,460	59	42	12,502
1943	116	4,060	17	12	4,072

Gold.—The output of recoverable gold from lode and placer operations in Washington in 1943 was 65,244 fine ounces, a 13-percent decrease from the output in 1942. Nearly all the gold-producing mines in the State had closed by midyear 1943; those remaining open had received special dispensation from the War Production Board because of their importance as flux producers or peculiar conditions of operation. This, in addition to the lowering in gold content of the ores treated by the Howe Sound Co., caused the decline in gold production in the State. The Holden property of the Howe Sound Co., which yielded gold as a byproduct of the production of copper and zinc, was again the largest gold producer in the State and supplied about 64 percent of the State total; it was followed by Knob Hill Mines, Inc., which treated gold ore from its Knob Hill mine in Ferry County throughout 1943 by cyanidation and concentration. These two properties furnished over 96 percent of the State total output. Other gold-producing properties included the Aurum and Valley mines, both in the Republic district, Ferry County. The total output of gold ore was 61,002 tons in 1943, compared with 93,957 tons in 1942; it was treated as follows: 51,135 tons in a cyanidation-concentration mill and 9,867 tons shipped crude to smelters. Placers yielded 116 ounces of gold.

Silver.—The output of recoverable silver in Washington was slightly greater in 1943 than in 1942; gains in output from mines in Ferry, Okanogan, and Whatcom Counties more than offset losses in other silver-producing counties. The principal production came from mines in Ferry, Chelan, Okanogan, and Stevens Counties; mines in Ferry and Chelan Counties produced 85 percent of the State total. Gold ore yielded 47 percent of the total silver; zinc-copper ore, 38 percent; zinc-lead ore, 11; and zinc, lead, copper, silver, and gold-silver ores, and placers, the remainder. The Knob Hill property of Knob Hill Mines, Inc., in Ferry County was the largest silver producer in the State; it was followed by the Holden property of the Howe Sound Co. in Chelan County and the Kaaba property of the Kaaba-Texas Co. in Okanogan County; these three properties furnished 91 percent of the State total silver. Other producers of silver were the Aurum property in Ferry County, the Sierra Zinc Co. property in Stevens County, and the Pend Oreille Mines & Metals Co. property in Pend Oreille County. A placer mine yielded the 17 fine ounces of silver.

Copper.—The output of recoverable copper in Washington in 1943 was less than in any year since 1938 and 9 percent less than in 1942. Almost all (99 percent) of the State total copper was recovered from the zinc-copper ores of the Holden property of the Howe Sound Co. The company shipped copper concentrates rich in gold to the Tacoma smelter for treatment. The value of the gold content of the copper concentrates was equivalent to 78 percent of the value of the copper. Following the Howe Sound Co. as copper producers were the Sunset mine of the Kromona Mines Corporation in Snohomish County, the Kaaba property of the Kaaba-Texas Co. in Okanogan County, and the Lucky Boy mine in Stevens County.

Lead and zinc.—The production of recoverable zinc in Washington in 1943 declined 4,390,000 pounds (15 percent) compared with 1942, but the output of recoverable lead reached a new high, exceeding that in any year of the State's history. Mines in Pend Oreille County—by far the most important source of zinc and lead in the State—produced a slightly greater quantity of lead than in 1942 but showed a decrease of nearly one-third in zinc production. Shortages of labor and power, as well as a change in grade of ore, were factors contributing to the loss in zinc output; change in grade of ore treated resulted in the increase in lead output. The Howe Sound Co. recovered zinc from its zinc-copper ore and ranked third as a source of this metal in 1943. Most of the remaining lead and zinc output was recovered from mines in Stevens County. Zinc-lead ore treated in 1943 in the two flotation mills (Pend Oreille and Grandview) in Pend Oreille County decreased 86,381 tons from that treated in 1942. It averaged 1.70 percent in lead and 3.80 percent in zinc compared with 1.50 percent in lead and 4.70 percent in zinc in 1942. Zinc and zinc-lead ores treated in Stevens County totaled 21,112 tons in 1943 compared with 14,064 tons of zinc-lead ore in 1942. The average grade of the ore was higher than that treated from mines in Pend Oreille County.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Washington in 1943, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Asotin		1	2	$70		
Benton		1	114	3,990	17	$12
Chelan	1		41,920	1,467,200	141,930	100,928
Ferry	7		22,927	802,445	173,115	123,104
Okanogan	3		2	70	31,095	22,112
Pend Oreille	3				7,335	5,216
Snohomish	1		11	385	1,035	736
Stevens	8		267	9,345	15,830	11,257
Whatcom	1		1	35	83	59
	24	2	65,244	2,283,540	370,440	263,424
Total, 1942	37	18	75,396	2,638,860	369,038	262,427

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Asotin							$70
Benton							4,002
Chelan	14,437,000	$1,876,810	12,000	$900	3,860,000	$416,880	3,862,718
Ferry	12,000	1,560					927,109
Okanogan	39,000	5,070	304,000	22,800	106,000	11,448	61,500
Pend Oreille			9,161,000	687,075	18,584,000	2,007,072	2,699,363
Snohomish	98,000	12,740					13,861
Stevens	43,600	5,668	567,000	42,525	1,856,000	200,448	269,243
Whatcom	400	52					146
	14,630,000	1,901,900	10,044,000	753,300	24,406,000	2,635,848	7,838,012
Total, 1942	16,060,000	1,943,260	9,702,000	650,034	28,796,000	2,678,028	8,172,609

Gold and silver produced at lode mines in Washington in 1943, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Chelan	720,560	41,920	141,930
Ferry	61,002	22,927	173,115
Okanogan	14,526	2	31,095
Pend Oreille	311,245	--------	7,335
Snohomish	1,942	11	1,035
Stevens	21,983	267	15,830
Whatcom	23	1	83
	1,131,281	65,128	370,423
Total, 1942	1,222,937	75,040	368,979

Gold and silver produced at placer mines in Washington in 1943, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Dragline and dry-land dredges [1]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Asotin	2	--------	--------	--------	2	--------
Benton	--------	--------	114	17	114	17
	2	--------	114	17	116	17
Total, 1942	35	2	321	57	356	59

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

MINING INDUSTRY

Seven properties in Washington produced 1,116,783 tons of ore in 1943—99 percent of the State total. This output included zinc-copper ore from the Holden mine in Chelan County; zinc-lead ore from the Pend Oreille, Metaline, and Grandview mines in Pend Oreille County and the Kaaba-Texas property in Okanogan County; zinc ore from the Blue Ridge property in Stevens County; and gold ore from the Knob Hill property in Ferry County. Development completed on company account in these seven properties in 1943 included 16,941 feet of drifts, raises, shafts, and tunnels and 47,774 feet of diamond drilling. Aside from development and exploration on company account, the Government through its various agencies, particularly the Bureau of Mines, completed several thousand feet of diamond drilling.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Washington in 1943, with content in terms of recovered metals

Source	Mines producing[1]	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	7	61,002	22,927	173,115	12,000		
Dry and siliceous gold-silver ore	2	74	2	146	400		
Dry and siliceous silver ore	2	144	1	753	350	2,900	
Copper ore	2	2,339	11	1,119	123,700		
Lead ore	4	374		1,859		211,692	
Zinc ore	1	19,412	263	9,150	17,550	250,200	1,828,000
Zinc-copper ore	1	720,560	41,920	141,930	14,437,000	12,000	3,860,000
Zinc-lead ore	5	327,376	4	42,351	39,000	9,567,208	18,718,000
Total, lode mines	24	1,131,281	65,128	370,423	14,630,000	10,044,000	24,406,000
Total, placers	2		116	17			
	26	1,131,281	65,244	370,440	14,630,000	10,044,000	24,406,000
Total, 1942	55	1,222,937	[2]75,396	[2] 369,038	16,060,000	9,702,000	28,796,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[2] Includes 940 ounces of gold and 2,557 ounces of silver from current tailings cyanided.

METALLURGIC INDUSTRY

Lode mines in Washington produced 1,131,281 tons of ore in 1943, which was treated as follows: 51,135 tons in a cyanidation-concentration mill, 1,069,745 tons in concentrating mills, and 10,401 tons shipped crude to smelters.

Cyanidation mills.—The cyanidation-concentration mill of Knob Hill Mines, Inc., was the only plant of this type active in 1943. It treated a total of 51,135 tons of gold ore and consumed 69,700 pounds of calcium cyanide, 8,580 pounds of zinc dust, and 489,400 pounds of lime; the operation was continuous throughout 1943.

Concentration mills.—Nine concentration mills treated a total of 1,069,745 tons of ore, as follows: One plant 720,560 tons of zinc-copper ore, four plants 327,376 tons of zinc-lead ore, one plant 19,412 tons of zinc ore, and three plants a total of 2,397 tons of copper and silver ores.

Details of the treatment of all ore produced in Washington in 1943 are given in the following tables.

Mine production of metals in Washington in 1943, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore cyanided	47,004	2,083	10,770			
Concentrates smelted	66,465	60,944	347,432	14,598,181	9,830,308	24,406,000
Ore smelted	10,401	2,101	12,221	31,819	213,692	
Placer		116	17			
		65,244	370,440	14,630,000	10,044,000	24,406,000
Total, 1942		[1] 75,396	[1] 369,038	16,060,000	9,702,000	28,796,000

[1] Includes 264 ounces of gold and 87 ounces of silver recovered in amalgamation bullion; no amalgamation in 1943.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Washington in 1943, by types of mills and by counties, in terms of recovered metals

CYANIDATION MILLS

County	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal		
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)
Ferry	51,135	2,083	10,770	4,153	18,749	152,830
Grand total: 1943	51,135	2,083	10,770	4,153	18,749	152,830
1942	[1] 71,357	[2] 4,207	[2] 18,178	3,506	17,757	125,094

[1] Also 180,000 tons of current tailings (from copper ore concentrated in Chelan County) were cyanided.

[2] Includes 264 ounces of gold and 87 ounces of silver recovered in amalgamation bullion; no amalgamation in 1943.

Mine production of metals from concentrating mills in Washington in 1943, by counties, in terms of recovered metal

County	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Chelan	720,560	35,809	41,920	141,930	14,437,000	12,000	3,860,000
Okanogan	14,431	423		30,586	39,000	302,000	106,000
Pend Oreille	311,245	23,883		7,335		9,161,000	18,584,000
Snohomish	1,900	141	8	780	78,581		
Stevens	21,609	2,056	267	13,971	43,600	355,308	1,856,000
	1,069,745	62,312	42,195	194,602	14,598,181	9,830,308	24,406,000
Total, 1942	1,130,075	67,986	47,665	197,935	15,991,791	9,595,622	28,796,000

Gross metal content of concentrates produced from ores mined in Washington in 1943, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	4,153	18,749	152,830	8,824		
Copper	31,787	41,735	141,154	14,941,393	40,000	2,477,832
Lead	6,778	81	47,977	52,781	10,053,145	326,945
Zinc	23,613	379	9,282	67,769	468,409	27,446,209
Zinc-copper	134		773	10,661	6,730	118,397
	66,465	60,944	352,016	15,081,428	10,568,284	30,369,383
Total, 1942	71,492	65,422	323,029	16,493,701	10,134,202	32,503,154

Mine production of metals from Washington concentrates shipped to smelters in 1943, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Chelan	35,809	41,920	141,930	14,437,000	12,000	3,860,000
Ferry	4,153	18,749	152,830			
Okanogan	423		30,586	39,000	302,000	106,000
Pend Oreille	23,883		7,335		9,161,000	18,584,000
Snohomish	141	8	780	78,581		
Stevens	2,056	267	13,971	43,600	355,308	1,856,000
	66,465	60,944	347,432	14,598,181	9,830,308	24,406,000
Total, 1942	71,492	65,422	323,029	15,901,791	9,595,622	28,796,000

BY CLASSES OF CONCENTRATES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	4,153	18,749	152,830			
Copper	31,787	41,735	141,154	14,493,681		
Lead	6,778	81	43,393	30,932	9,617,560	10,250
Zinc	23,613	379	9,282	63,368	206,355	24,289,750
Zinc-copper	134		773	10,200	6,393	106,000
	66,465	60,944	347,432	14,598,181	9,830,308	24,406,000

Gross metal content of Washington crude ore shipped to smelters in 1943, by classes of ore

Class of ore	Ore (short tons)	Gross metal content			
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry and siliceous gold	9,867	2,095	9,515	13,347	
Dry and siliceous gold-silver	74	2	146	600	93
Dry and siliceous silver	44	1	446	157	2,077
Copper	42	3	255	20,078	
Lead	374		1,859	62	220,458
	10,401	2,101	12,221	34,244	222,628
Total, 1942	21,505	5,411	27,772	71,203	111,668

Mine production of metals from Washington crude ore shipped to smelters in 1943' in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Ferry	9,867	2,095	9,515	12,000	
Okanogan	95	2	509		2,000
Snohomish	42	3	255	19,419	
Stevens	374		1,859		211,692
Whatcom	23	1	83	400	
	10,401	2,101	12,221	31,819	213,692
Total, 1942	21,505	5,411	27,772	68,209	106,378

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry and siliceous gold	9,867	2,095	9,515	12,000	
Dry and siliceous gold-silver	74	2	146	400	
Dry and siliceous silver	44	1	446		2,000
Copper	42	3	255	19,419	
Lead	374		1,859		211,692
	10,401	2,101	12,221	31,819	213,692

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Washington in 1943, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Asotin County:									
Snake River	......	1	....	2	....	....	....	....	$70
Benton County:									
Columbia River	......	1	....	114	17	....	....	....	4,002
Chelan County:									
Chelan Lake	1	......	720,560	41,920	141,930	14,437,000	12,000	3,860,000	3,862,718
Ferry County:									
Danville	1	......	272	289	360	12,000	....	....	11,931
Republic	6	......	60,730	22,638	172,755	....	....	....	915,178
Okanogan County:									
Conconully	2	......	95	2	509	....	2,000	....	582
Loomis-Oroville	1	......	14,431	....	30,586	39,000	302,000	106,000	60,918
Pend Oreille County:									
Metaline	3	......	311,245	....	7,335	....	9,161,000	18,584,000	2,699,363
Snohomish County:									
Index	1	......	1,942	11	1,035	98,000	....	....	13,861
Stevens County:									
Bossburg	1	......	232	....	1,059	....	98,600	....	8,148
Deer Trail	2	......	1,708	4	5,175	....	106,400	28,000	14,824
Northport	4	......	19,646	263	9,512	17,900	362,000	1,828,000	242,870
Springdale	1	......	397	....	84	25,700	....	....	3,401
Whatcom County:									
Mount Baker	1	......	23	1	83	400	....	....	146
Total Washington	24	2	1,131,281	65,244	370,440	14,630,000	10,044,000	24,406,000	7,838,012

BENTON COUNTY

The gold output from Benton County in 1943 came from a dry-land dredge operating on the Columbia River.

CHELAN COUNTY

Chelan Lake district.—The Holden mine of the Howe Sound Co. was the leading producer of gold and copper, second in silver, and third in zinc in Washington in 1943. The company treated 720,560 tons of zinc-copper-gold-silver ore, which averaged 0.075 ounce of gold and 0.27 ounce of silver to the ton, 1.09 percent copper, and 0.62 percent zinc. Although the company treated 4,834 tons more ore than in 1942, the metal content, particularly the copper, was lower, resulting in decreased copper production for the State. The smaller gold content aided materially in lowering the State total gold output. In 1942 the company added equipment to its 2,000-ton flotation concentrator and took other steps necessary to effect recovery of zinc from its zinc-copper ore. Zinc concentrates were first shipped in January 1943. The Howe Sound Co. states in its printed annual report, dated December 31, 1943, that at the Chelan Division the shortage of labor continued throughout 1943. It became necessary, as in 1942, for the Army to release men for work in the base-metal mines. The Holden property received its proportional quota; but, in spite of the help, the number of underground employees at the close of the year was materially less than on January 1, 1943. Because of this situation it was impossible to carry on the required amount of development and exploration; and a shaft, which is being sunk below the main haulage adit, could not be completed. Ore reserves developed in prior years cannot be made available for milling until this shaft is completed. Although the plant was operated at full capacity throughout the year with only minor delays, a substantial portion of the ore produced was broken in low-grade areas. To maintain production of copper for the war program, the War Production Board granted price consideration for this material, which otherwise could not have been handled. At the end of the year the ore-reserve situation was excellent, but until the main hoisting shaft is completed the principal source of production will be the low-grade ore bodies mentioned. Total footage of development completed in 1943 was equivalent to about one-half that completed in 1942 and included the completion of 267 feet of shaft, 8,650 feet of drifts and raises, and 6,455 feet of diamond drilling.

FERRY COUNTY

Danville district.—The Morning Star Mining Co. operated its gold-copper property from January to September 15, 1943, and shipped 272 tons of gold-copper ore crude to Tacoma.

Republic district.—Mines in the Republic district were the chief source of siliceous ores in Washington in 1943. They produced 60,730 tons, of which 51,135 were treated by cyanidation-concentration and 9,595 shipped crude to the Tacoma smelter. Knob Hill Mines, Inc., operated throughout 1943, treated 51,135 tons of ore from its Knob Hill mine in its 400-ton cyanidation-concentration mill. The mill produced 4,153 tons of gold concentrates, which were shipped to Tacoma for smelting; the gold bullion was shipped to the Seattle Assay Office. The ore treated in 1943 had a higher gold and silver content than in 1942; in consequence, the Knob Hill mine became the leading silver producer and the second-largest gold producer in the State. The company stated that all production in 1943 came from underground mining. Development in 1943 amounted to completion of 1,100 feet of drifts.

The Aurum Mining Co. property was operated by lessees in 1943; production was considerably smaller than in previous years, but the property remained the chief source in Washington of siliceous ores shipped crude to a smelter. The Valley mine and dump produced 1,302 tons of highly siliceous gold ore, which was shipped direct to the Tacoma smelter. Other production in the district included crude ore shipped direct to a smelter from the South Penn and Mountain Lion properties.

OKANOGAN COUNTY

Conconully district.—The Conconully district in 1943 produced ore, which was shipped crude to smelters from the Lone Star and Silver Star properties.

Loomis-Oroville district.—The Kaaba-Texas Mining Co. operated its 150-ton flotation mill intermittently in 1943 and treated 14,431 tons of zinc-copper-lead-gold ore. The ore treated was quite low grade (averaging 2.4 ounces of silver to the ton, 0.3 percent copper, 1.4 percent lead, and 1.0 percent zinc), and the company could not maintain steady mill runs until October 1943 owing to machinery trouble and lack of manpower; mill recoveries during the year were high. The average daily tonnage of ore treated during the last quarter of 1943 was 105 tons. The mine is developed through a

390-foot shaft, from which about 2,000 feet of drifts have been driven. The Bureau of Mines examined the property in 1943 and by sampling indicated the presence of approximately 40,000 tons of ore of about the same metal content as shown above. Recommendations were made that if carried out would explore certain areas of the mine that show promise of containing higher-grade ore.

PEND OREILLE COUNTY

Metaline district.—Mines in the Metaline district continued to supply the major portion of the lead and zinc output in the State. The value of the recoverable metal was $2,699,363 in 1943 compared with $3,150,270 in 1942. The decrease was the combined result of labor shortages, power shortages, and lowering of the zinc content of the ores treated.

An extensive drilling campaign was started in 1943 by the Bureau of Mines, working through its Western Regional Office at Salt Lake City, Utah, on the mineral-bearing areas controlled by the Pend Oreille Mines & Metals Co. and the American Zinc, Lead & Smelting Co. From the time the program was begun in January 1943 up to February 1944 a total of 17,332 feet of hole had been drilled. Of this total, 5,905 feet were drilled on the Metaline Mining & Leasing Co. ground (controlled by the American Zinc, Lead & Smelting Co.) and the rest on Pend Oreille Mines & Metals Co. ground. As of February 1, 1944, it is estimated that Bureau of Mines diamond drilling has indicated approximately 9,000,000 tons of about 5 to 7 percent combined metals in zinc-lead ore. Additional reserves totaling about 3,000,000 tons have been outlined over a period of years by the principal operating companies in the district. The Bureau of Mines made certain recommendations calculated to increase the output of zinc and lead in the district.

The Pend Oreille Mines & Metals Co. was again the leading producer of zinc and lead in the district. The company operated its property throughout 1943 and treated daily an average of 504 tons of ore in its 700-ton concentration mill. On account of a labor shortage at the mine during 1943 and a shortage of electric power that developed in the latter part of March and continued throughout April, the tonnage of ore mined dropped approximately 13 percent from 1942. The lead concentrates produced averaged about 78 percent and the zinc concentrates 61 percent. The average grade of the ore treated in 1943 was 1.41 percent lead and 3.34 percent zinc compared with 1.66 percent lead and 4.28 percent zinc in 1942. The printed annual report of the Pend Oreille Mines & Metals Co., dated for the fiscal year ended April 30, 1943, states:

> Every effort was made to maintain output at the highest possible level but at the expense of underground development work, which, on account of the labor shortage, was necessarily curtailed. As soon as men are made available, our development work will be greatly accelerated in view of increasing operations.

According to the company report for the calendar year 1943, mine development amounted to completion of 3,302 feet of shafts, raises, and tunnels and 24,669 feet of diamond drilling.

The rest of the production of the district came from the Grandview mine of the American Zinc, Lead & Smelting Co. and the property of the Metaline Mining & Leasing Co., both operated by the American

Zinc, Lead & Smelting Co. The Grandview mine produced 81,881 tons of milling ore, which was concentrated into 7,885 tons of zinc and lead concentrates. Because of a power shortage, production from the mine was very small during March, April, and May. The printed annual report of the American Zinc, Lead & Smelting Co., dated December 31, 1943, states:

> Development work consisted of 2,922 feet of drifts and raises, 5,510 feet of surface diamond drilling, and 10,840 feet of underground drilling. Development was expanded during the year up to the limit of available manpower, which permitted increased production rate for the last half of the year. At the end of the year, the developed condition of the mine was much improved and satisfactory for the maintenance of the current expanded production rate. Surface diamond-drill prospecting ahead of the underground development has indicated further ore extensions. Our present underground development program contemplates making these ores available for mining the latter part of 1944.

The property of the Metaline Mining & Leasing Co., operated by the American Zinc, Lead & Smelting Co., produced 46,322 tons of zinc-lead ore, which was concentrated into 3,883 tons of zinc and lead concentrates. The output from this property was curtailed in April because of a power shortage. When enough power was made available, the production rate again reached normalcy consistent with the availability of manpower. Development on the property was expanded during the year to the limit of available manpower.

SNOHOMISH COUNTY

Index district.—The only active producer in the Index district in 1943 was the Kromona Mines Corporation. The output in 1943 was substantially the same as in 1942 and included crude copper ore shipped direct to the Tacoma smelter.

STEVENS COUNTY

Bossburg district.—Russell Parker operated the Bonanza mine throughout 1943 and shipped 232 tons of silver-lead ore crude to the Bunker Hill smelter. The ore averaged 4.5 ounces of silver to the ton and 22 percent lead.

Deer Trail district.—The production from the Deer Trail district in 1943 comprised zinc-lead ore milled from the Cleveland mine and crude lead ore shipped direct to a smelter from the Deer Trail mine.

Northport district.—The Sierra Zinc Co. operated its Blue Ridge property throughout 1943 and was the largest producer in the district. The company treated 19,412 tons of zinc ore in its 90-ton flotation mill. The lead concentrates produced averaged 66 percent lead and the zinc concentrates about 55 percent zinc. The ore milled during 1943 averaged about 0.35 ounce of silver to the ton, less than 1 percent lead, and slightly over 6 percent zinc. Development during the year included the completion of 700 feet of raises and tunnels and 300 feet of diamond drilling. During 1943 the Bureau of Mines, working through its Western Regional Office in Salt Lake City, Utah, examined the property. It was determined that present ore reserves show approximately 23,000 tons of measured and indicated ore containing about 11 percent zinc and 2 percent lead. Surface outcrops of ore indicate an expectancy of several times this tonnage. Based upon this examination, the Bureau began a diamond-drilling campaign in 1944 to explore adequately the possible extension of surface ore indications.

Other production in the Northport district included lead ore, from the Electric Point and Gladstone Mountain mines, that was shipped crude to a smelter, and silver ore, from the Frisco-Standard mine, that was milled to produce lead-copper concentrates.

Springdale district.—Copper ore from the Lucky Boy mine treated in the Deer Trail flotation mill comprised the only output in the Springdale district in 1943. The copper concentrates produced were shipped to Tacoma.

WHATCOM COUNTY

Mount Baker district.—Gold-silver ore was shipped crude to a smelter from the Silver Tip mine in 1943.

GOLD, SILVER, COPPER, AND LEAD IN WYOMING

(MINE REPORT)

By CHAS. W. HENDERSON AND R. V. CUSHMAN

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SUMMARY

There was no production from either lode or placer mines in Wyoming in 1943.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1939–43

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1939	$35.00	[4] $0.678+	$0.104	$0.047	$0.052
1940	35.00	[5] .711+	.113	.050	.063
1941	35.00	[5] .711+	.118	.057	.075
1942	35.00	[5] .711+	.121	.067	.093
1943	35.00	[5] .711+	.130	.075	.108

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.

[2] Treasury buying price for newly mined silver.

[3] 1939–41: Yearly average weighted price of all grades of primary metal sold by producers; 1942–43: Price includes bonus payments by Metals Reserve Co. for overquota production.

[4] $0.67878787.

[5] $0.71111111.

The following table shows the annual output of ore from lode mines producing gold, silver, copper, and lead and the quantity and value of the metals recovered from both lode and placer mines in Wyoming from 1939 to 1943; it also gives the total production of metals from 1867 to 1943. About three-fourths of the total recorded value of the four metals is in copper, most of which was mined before 1924 in the Encampment district, in Carbon County, and the Hartville district, originally in Laramie County, now in Platte County.

Mine production of gold, silver, copper, and lead in Wyoming, 1939–43, and total, 1867–1943, in terms of recovered metals

Year	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Total
		Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	
1939	57	583	$20,405	75	$51					$20,456
1940	813	740	25,000	114	81	4,000	$452			26,433
1941	159	478	16,730	94	67	8,000	944			17,741
1942	84	23	805	52	37			6,000	$402	1,244
1943										
1867-1943	(1)	77,914	1,835,318	74,632	51,752	[2] 16,325	5,684,048	[2] 11	970	7,572,088

[1] Figures not available.

[2] Short tons.

SECONDARY METALS—NONFERROUS

By F. H. Wright [1]

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GENERAL SUMMARY

The recovery of nonferrous secondary metals from purchased scrap in 1943 was increased by record-breaking quantities of industrial scrap emanating from the manufacture of war equipment. The flow of segregated metal clippings and turnings from factories back to wrought-alloy producers and ingot makers was maintained in a never-ending stream, with such dispatch that corrosion and contamination were held to a minimum, and an unusual proportion of the new scrap generated was suitable for blending with primary metal in alloys produced to standard specifications. Toward the end of 1943, when the supply of nonferrous metals caught up with requirements, a few types of scrap, such as leaded-brass rod turnings and mixed aluminum, started to pile up enough to cause some concern as to their disposal, but this problem did not become serious.

Sources of old scrap were depleted, and collection drives held in various parts of the country had little success; but the quantity of obsolete and worn-out metal objects unearthed by scrap-metal dealers was nevertheless more than had been expected, particularly in view of a severe labor shortage brought about by the drain to both the armed services and higher-paid industries.

Salient statistics of nonferrous secondary metals recovered in the United States, 1942–43

Metal	New scrap		Old scrap		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1942						
Aluminum	154, 831	$45. 272. 585	[1] 41, 633	[1] $12, 173, 489	[1] 196, 464	[1] $57, 446, 074
Antimony	3	934	18. 197	5. 662, 906	18, 200	5, 663, 840
Copper	500. 633	118, 149, 388	427, 122	100, 800. 792	927. 755	218. 950. 180
Lead	14. 413	1. 816. 038	308. 588	38, 882. 088	323. 001	40. 698. 126
Magnesium	6, 151	2, 755. 648	87	38, 976	6. 238	2. 794. 624
Nickel	2. 430	1. 701. 000	1, 712	1, 198. 400	4, 142	2. 899. 400
Tin	14, 057	14. 619. 280	23, 861	24. 815, 440	37. 918	39. 434. 720
Zinc	257. 539	44, 811. 786	72. 987	12. 699, 738	330. 526	57, 511, 524
	----------	229, 126. 659	----------	[1] 196. 271, 829	----------	[1] 425, 398, 488
1943						
Aluminum	280. 867	81, 002, 042	33. 094	9, 544, 310	313. 961	90. 546. 352
Antimony	62	19, 741	15. 421	4, 910, 046	15. 483	4. 929. 787
Copper	658. 526	155. 412, 136	427. 521	100. 894. 956	1. 086. 047	256, 307, 092
Lead	31, 391	4, 018. 048	309. 852	39, 661. 056	341, 243	43. 679, 104
Magnesium	11, 254	4, 735. 683	150	63. 120	11. 404	4, 798, 803
Nickel	5, 058	3, 540, 600	1, 859	1, 301. 300	6, 917	4. 841. 900
Tin	12. 643	13, 148, 720	25. 177	26. 184. 080	37, 820	39, 332. 800
Zinc	284. 263	48. 893, 236	84, 225	14. 486. 700	368, 488	63. 379, 936
	----------	310, 770, 206	----------	197, 045, 568	----------	507, 815, 774

[1] Revised figures.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Although the value of metals recovered in 1943 from old scrap alone was $197,045,568, slightly more than in the year before, the value of metals reclaimed from new scrap rose to $310,770,206 compared with $229,126,659 in 1942, raising the total value of secondary metals to $507,815,774 in 1943 in contrast with $425,398,488 in 1942.

Remelters and smelters of aluminum, copper, and brass scrap expanded to virtually full capacity, and a number of the smaller concerns were able to grow enough to entrench themselves as recognized competitors to older firms; but there was little opportunity for newcomers to enter the field of secondary smelting in 1943, not only because it was difficult to find building materials and equipment, but also because Government war agencies were loath to approve new installations when existing plants had sufficient capacity to carry the load.

Secondary metals recovered as unalloyed metal, in alloys, and in chemical compounds in the United States, 1939–43, in short tons

	1939	1940	1941	1942	1943
Aluminum	53, 947	80, 362	106, 857	196, 464	313, 961
Antimony	9, 810	11, 421	21, 629	18, 200	15, 483
Copper	499, 700	532, 046	726, 396	927, 755	1, 085, 317
Lead	241, 500	260, 346	397, 416	323, 001	341, 243
Magnesium	(1)	(1)	1, 752	6, 238	11, 404
Nickel	2, 920	4, 152	5, 315	4, 142	5, 560
Tin	29, 160	33, 222	42, 033	37, 918	37, 820
Zinc	189, 640	222, 013	283, 967	330, 526	368, 488

[1] Data not available.

The technology of smelting secondary metals made notable advances during both 1942 and 1943. The composition of nonferrous alloys made from scrap was controlled by chemical analysis and physical testing to a degree never before attained, and the care exercised in the makeup of scrap melts to avoid contamination of the resulting product showed great improvement. Realloyed aluminum ingot made entirely from scrap met a number of specifications formerly requiring primary metal, and when the supply of zinc ore could not fill the raw material needs at primary zinc smelters, zinc-bearing flue dust was consumed in increasing quantities for production of distilled metal. Another development was the widespread practice of smelting low-grade copper, brass, and bronze scrap in cupolas to produce a stock alloy that could be used as a base to make soft red brass or composition ingot.

Scrap and secondary metals were rigidly controlled to prevent their use in nonessentials, and despite the thousands of concerns engaged in buying and selling or remelting and smelting scrap metals, prices were kept well under restraint.

The American Institute of Mining and Metallurgical Engineers at its annual convention in New York in February 1943 devoted an entire day to a Secondary Metals Symposium. Papers presented were printed in Metals Technology—American Institute of Mining and Metallurgical Engineers, volume 10, No. 7, October 1943, as follows:

Problems of the Producer in Segregation and Reclamation, by F. E. Bliven.

Mechanics of Secondary Metals Collection, by Ray Schmidt.

Problems of the Consumer of Scrap in Segregation and Reclamation, by L. S. Deitz, Jr.

Specifications and Conservation, by C. S. Cole.
Available Brass and Bronze Ingots for Implements of War, by W. Romanoff.
Recovery of Copper from Clad Steel Scrap, by G. L. Craig.
Metallurgy of Secondary Tin and Lead, by G. E. Behr.
Scrap Metals from Ordnance, by L. S. Thomas.
Secondary Aluminum in War Production, by J. J. Bowman.
Secondary Magnesium, by C. E. Nelson.
Wartime Changes in the Secondary Metals Industry, by F. H. Wright.

Other articles of interest were published early in 1944:

Hayward, Carle R., How to Smelt Battery-Plate Scrap: Eng. and Min. Jour. vol. 145, No. 3, March 1944, pp. 80–83.

Hall, J. J., Melting Non-Ferrous Metals: Metal Ind. (London), vol. 64, Nos. 3 and 4, January 1944.

Miller, H. J., Secondary Copper-Base Materials: Metal Ind. (London), vol. 64, No. 10, March 10, 1944.

Kempf, L. W., Considerations Regarding the Post-war Utilization of Aluminum and Magnesium: Am. Metal Market, vol. 51, No. 10, January 14, 1944.

Korn, A., The Aluminum Scrap Market and Post-war Secondary Industry: Am. Metal Market, vol. 51, No. 108, June 3, 1944.

POST-WAR PROSPECTS

Numerous suggestions were advanced both from industrial and Government sources during 1943 for disposal of semifabricated metal parts and scrap left in manufacturing plants as war contracts ended. Uncut metal stock and semifabricated parts left over from a few plants that had already ceased operations were redistributed to other manufacturers, and clean-up scrap was readily absorbed, but the expectation of a major cut in production at the end of the war in Europe posed serious problems for the future, particularly in aluminum and brass.

Because new industrial scrap was not allowed to accumulate to any great extent during full-scale war production, disposal of the remainder when production ceased might not be difficult, but if several hundred thousand tons of semifabricated aluminum and brass were to be thrown on the scrap market all at once, the effect would be disastrous. This problem will be aggravated further by the availability, in unprecedented quantities, of old scrap from battle fronts and surplus or obsolete matériel. Estimates ranging from 250,000 to 500,000 tons of aluminum and from 750,000 to 1,000,000 tons of copper (mostly in brass) have been suggested as the quantities that might be expected to be reclaimed annually from old scrap for 4 or 5 years following the end of the war, provided industry could absorb that much. Although the zinc contained in brass might be sufficient to curtail drastically the refined-zinc requirements for post-war brass production, other war uses of zinc for smoke screens and galvanizing dissipated the metal, and no unusual return of zinc-base scrap could be expected. The outlook for lead promised enlarged supplies of old scrap in post-war years, owing to the increased consumption of both domestic and imported metal.

It was proposed that the Government retain title to both scrap and semifabricated metals already in its possession and either release them gradually as needed for civilian production or have them converted by secondary smelters and refiners into ingots, bars, and billets for stock piling, but no legislation toward this end was enacted either in 1943 or the first half of 1944.

SCOPE OF REPORT

Statistics on scrap and secondary metal for 1943 were derived from a variety of surveys covering all known dealers and consumers of purchased nonferrous scrap metals. Reports were received upon a monthly or annual basis from 375 plants classed as remelters, smelters, or refiners; from 1,030 plants classed as rolling mills, foundries, chemical works, or other manufacturers; and from approximately 4,500 dealers in nonferrous scrap metal. The major parts of the secondary lead and zinc industries and the entire scrap-dealer trade were canvassed monthly by the Bureau of Mines, but figures for consumption of aluminum scrap and ingot production by makers of aluminum ingot, as well as the detailed break-down of copper alloys produced by makers of brass ingot, were obtained from monthly surveys conducted by the War Production Board. All other figures in this report were derived from annual surveys conducted by the Bureau of Mines.

"Secondary metals" are metals or alloys recovered from scrap and residues. The term "secondary" applies only to the source of metal and has no relation to the type of product recovered, either as to degree of purity or impurity or physical characteristics.

"Purchased scrap" means all scrap that entered the gates of any plant in scrap form and includes scrap treated for customers upon a toll basis or conversion agreement and interplant transfers of scrap.

"Interplant transfers" are those made between separate plants owned or operated by the same parent company but not located on the same ground. A transfer of scrap from a machine shop to a foundry at the same plant location is not an interplant transfer, and such "home scrap" is not included in this report.

"New scrap" is defined as the refuse produced during the manufacture of articles for ultimate consumption, including all defective finished or semifinished articles that must be reworked. Typical examples of new scrap are defective castings, clippings, punchings, turnings, borings, skimmings, drosses, and slag.

"Old scrap" is defined as scrap consisting of metal articles that have been discarded after serving a useful purpose. Typical examples of old scrap are discarded trolley wire, battery plates, railroad-car boxes, fired cartridge cases, automobile crankcases, used pipe, and lithographers' plates.

SECONDARY ALUMINUM [2]

The recovery of aluminum from scrap in 1943 was far greater than ever before, totaling 313,961 short tons valued at $90,546,352 compared with 196,464 tons (revised) valued at $57,446,074 in 1942. The 1943 total was almost six times the quantity recovered in 1939, a typical prewar year, with the difference attributed entirely to new industrial scrap from war production. Values were computed upon the basis of the replacement value of primary aluminum at 14.42 cents a pound in 1943 and 14.62 cents a pound in 1942.

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[2] The term "secondary aluminum" is used broadly to cover aluminum and aluminum alloys, including the weight of alloy constituents, such as copper, silicon, magnesium, and others.

Secondary aluminum [1] recovered in the United States, 1942–43, in short tons

Secondary aluminum recovered			Recoverable aluminum-alloy content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As metal	14,104	5,926	New scrap:		
Aluminum alloys	178,951	305,357	Aluminum-base [2]	154,436	280,065
In brass and bronze	1,268	1,279	Copper-base	297	724
In zinc-base alloys	473	219	Zinc-base	98	78
In chemical compounds	1,668	1,180			
				154,831	280,867
	196,464	313,961			
			Old scrap:		
			Aluminum-base [3]	[4] 41,221	32,414
			Copper-base	213	540
			Zinc-base	199	140
				[4] 41,633	33,094
				[4] 196,464	313,961

[1] In accordance with common usage, the term "aluminum" covers aluminum alloys, and the figures include all constituents of the alloys recovered from aluminum-base scrap.
[2] Aluminum content of new aluminum-base scrap was 143,633 tons in 1942 and 261,282 tons in 1943.
[3] Aluminum content of old aluminum-base scrap was 38,144 tons in 1942 and 29,714 tons in 1943.
[4] Revised figures.

Production [3] of realloyed (secondary) aluminum ingot rose from 83,933 short tons in 1941 to 144,694 tons in 1942, then to 196,373 tons in 1943, and output of wrought aluminum from purchased scrap at the plants of primary producers and other rolling mills went up from 14,221 tons in 1941 to 53,080 tons in 1942, then to 121,827 tons in 1943. This increased use of purchased scrap in wrought-aluminum products represented a triumph for the fabricators responsible for maintaining segregation of each type of scrap from the moment of generation at the machine until delivery to a remelter.

Production of secondary aluminum and aluminum-alloy products in the United States, 1941–43, gross weight, short tons

	1941	1942	1943
Secondary-aluminum ingot: [1]			
Pure aluminum (98.5 percent)	3,449	2,924	715
95.5 (silicon)	4,014	2,896	471
Other aluminum-silicon alloys	3,356	10,393	13,348
No. 12 aluminum	21,708	13,577	11,302
Other aluminum-copper alloys	6,477	24,135	25,160
Aluminum-copper-silicon alloys	10,113	21,480	24,861
Steel-mill ingot and shot	24,212	38,527	32,770
Die-casting alloys	4,431	7,928	8,390
Aluminum hardeners	4,747	2,731	6,267
Wrought alloys	(4)	18,874	45,063
"Primary" ingot [2]			1,401
Ingot for chemicals, powder, etc			14,536
Piston alloys	(4)	120	10,295
Miscellaneous	1,426	1,109	1,794
	83,933	144,694	[5] 196,373
Aluminum in wrought products [3]	14,221	53,080	121,827
Aluminum powder	1,663	848	961
Aluminum alloy castings	9,851	480	448
Aluminum in chemicals	935	1,668	1,180

[1] Gross weight of alloys, including copper, silicon, and other added elements; total secondary ingot contained 1,038 tons of primary aluminum in 1941, 938 tons in 1942, and 8,471 tons in 1943.
[2] "Primary" ingot is a new classification of ingot made from scrap with 30 to 50 percent primary aluminum added to bring specifications of the alloys equal to those made entirely from primary metal.
[3] Combined with primary aluminum in the products of aluminum rolling mills.
[4] Data not available.
[5] Includes 18,552 tons produced on toll.

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[3] Figures for aluminum scrap consumed by smelters and aluminum ingot produced were derived from a survey conducted by the War Production Board.

Makers of secondary aluminum ingot used 8,471 tons of primary aluminum and 8,916 tons of alloying ingredients, such as copper, silicon, and others, in addition to aluminum scrap. Technical advances in both remelting methods and quality of products were notable, and the secondary-metals industry earned a prominent position as a supplier of aluminum alloys meeting rigid specifications. In particular, its production of 45,063 tons of remelted aluminum suitable for blending with primary metal for use in wrought aluminum demonstrated the care with which scrap was handled and impurities held to a minimum at secondary smelters. The recovery of metal by all scrap users amounted to 89 percent of the gross weight of scrap consumed.

As in 1942, aluminum scrap was channeled either to primary producers or to approved secondary smelters, and manufacturers could obtain it only on special authorization. In consequence, only small amounts of aluminum chemicals, powder, and castings were made directly from scrap, although large quantities of these products were produced from secondary ingot and shot.

Consumption of purchased aluminum scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Aluminum rolling mills		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
Pure clippings, wire, and foil	5,044	....	10,517	....	4	78	15,643
Castings and forgings	6,234	22,590	484	295	202	184	29,989
Alloy sheet	22,587	3,107	94,963	....	....	19	120,676
Scrap sheet and sheet utensil	1,624	4,908	9,662	....	1	2	16,197
Borings and turnings	116,404	....	7,631	....	977	....	125,012
Die castings	67	....	4	....	22	....	93
Wrecked aircraft	....	2,981	....	....	....	....	2,981
Miscellaneous aluminum and dross	40,912	102	....	....	519	....	41,533
	[1] 192,872	33,688	123,261	295	1,725	283	352,124

[1] Includes 26,616 tons treated on toll.

Consumption of aluminum scrap totaled 352,124 short tons (gross weight) in 1943, an increase of 62 percent over the 217,611 tons melted in 1942. Ingot makers consumed 226,560 tons at 57 plants, of which 20 were "approved" smelters, 36 "limited" smelters, and 1 experimental. Primary producers and other rolling mills used 123,556 tons at 21 plants, and the remaining 2,008 tons were consumed by chemical works, foundries, and miscellaneous manufacturers numbering approximately 200. The sources of old aluminum scrap, such as pots and pans and obsolete castings, were depleted to such an extent that the downward trend in the use of old scrap in evidence since 1940 was extended more sharply, and only 34,266 tons were used in 1943 compared with 43,248 tons in 1942. Consumption of new aluminum scrap totaled 317,858 tons, almost double the quantity consumed in 1942.

The new scrap consumed by makers of aluminum ingot consisted of 50 percent segregated borings and turnings, 12 percent mixed borings and turnings, 14 percent segregated solids including both sheet and cast, 6 percent mixed solids, and 18 percent low-grade scrap such as skimmings and grindings. Purchased new scrap consumed by primary producers and other rolling mills consisted of 94 percent solids and 6 percent borings and turnings, presumably all segregated.

Dealers in scrap metal entered the aluminum field to a much greater extent in 1943 than ever before. Their receipts of aluminum scrap increased 40 percent—from 103,856 tons in 1942 to 145,975 tons in 1943—and shipments to consumers increased 30 percent to 130,295 tons, while stocks in dealers' yards soared from 8,720 tons at the beginning of the year to 25,072 tons at the close. Part of the idle stocks apparently consisted of mixed industrial scrap fit only for low-grade ingot, but even so there was not enough of a pile-up to cause serious concern.

During the first half of 1943, smelter demand for aluminum scrap paced supply, and wrecked aircraft from both foreign battle fronts and our own training fields were bought up "as is" by a number of makers of aluminum-ingot. This policy brought immediate disastrous results, for unexploded ammunition, vapor-filled gasoline tanks, and oil-charged hydraulic landing-gear cylinders caused numerous explosions in the plants; further, not only was it difficult to handle large airplane sections in the smelters, but the metal recovered from uncleaned scrap was of poor quality. On June 26, 1943, the War Production Board prohibited the delivery of unprepared wrecked aircraft to anyone except dealers; and from that time on, a system of double inspection for unexploded ammunition in battle front scrap was carefully carried out at Army salvage centers. Approximately 3,000 tons of wrecked airplanes were brought to the United States from battle areas in 1943, mostly during the last 6 months of the year, but disposal became such a problem that orders to stop this importation were issued on January 20, 1944.

Many of the large lots of wrecked aircraft advertised for sale by the Army and Navy were bought by scrap dealers who had little or no previous experience with aluminum. As clean industrial aluminum scrap was being purchased by dealers at 5 or 6 cents a pound, the opportunity to buy wrecked aircraft at 0.38 to 0.75 cent a pound was hard to resist, and huge piles of the bulky scrap rose in many yards. According to a study made early in 1944, at least 45 dealers had stocks of wrecked aircraft exceeding 25 tons apiece, and some of them had more than 10 times that amount.

Ingot makers reported consumption of 2,981 tons of wrecked aircraft in 1943, and dealers in scrap metal had about the same amount on hand at the end of the year. With poor demand and an unfavorable price structure for wrecked aircraft scrap, dealers had little incentive to spend much effort on preparation, and some lots were sold with only the largest pieces of foreign material removed and the aluminum either baled or sheared to size.

Consumers' stocks of purchased aluminum-base scrap in the United States at end of year, 1942–43, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1942	Dec. 31, 1943
Castings and forgings	1,690	785
Sheet, turnings, clippings, etc	5,020	7,843
Miscellaneous aluminum and dross	1,915	3,109
	8,625	11,737

On January 1, 1943, the order controlling the use and distribution of aluminum scrap, which was due to have expired December 31, 1942, was extended indefinitely. On March 16, 1943, the War Production Board tightened its orders by an amendment which required segregation of aluminum scrap by persons generating 500 pounds or more of aluminum scrap per month, but after October 6 the regulation was limited to those generating 1,000 pounds or more per month. On December 20, 1943, the requirement that aluminum scrap held by generators or dealers be moved within 60 days was revoked.

On January 5, 1943, a maximum base price of 15 cents was set for secondary aluminum ingot, except low-grade, which was set at 14.5 cents, but smelters were permitted to ask higher prices for special alloys. The base price was dropped to 14 cents on June 18, 1943, to conform with the 14-cent price of primary aluminum pig, and the ceiling prices of aluminum scrap, which until that time had remained unchanged from 1942 levels, were lowered 0.5 to 1 cent a pound, with segregated clippings of 17S, 18S, 32S, and 52S aluminum assigned a maximum price of 14.5 cents. Ceiling prices of both secondary aluminum ingot and aluminum scrap were dropped another 1.5 cents a pound on December 18, 1943, bringing the base price for ingot to 12.5 cents and reestablishing the pre-war spread between prices of primary and secondary aluminum. Prices actually paid for aluminum scrap were said to be well below ceilings during the latter half of 1943.

Dealers' buying prices for cast-aluminum scrap in New York averaged 6.99 cents a pound in 1943, the lowest in 10 years, whereas the average in 1942 was 8.62 cents. Monthly average quotations held at 8.12 cents from January to May 1943, then dropped to the low point of 5.18 cents in December. New aluminum clippings averaged 7.72 cents a pound in 1943 compared with 9.50 cents in 1942. The monthly average in 1943 was 9.12 cents for the first 5 months but gradually decreased to 5.79 cents in December.

Imports of aluminum scrap through commercial channels totaled 241 tons in 1943, but an additional 3,000 tons (approximate) of aluminum scrap from foreign battle fronts were brought back to the United States by the Army. Imports of aluminum scrap in 1942 totaled 24 tons (revised); exports totaled 14 tons in 1943 compared with 32 tons in 1942.

SECONDARY MAGNESIUM

The 11,404 short tons of secondary magnesium (including alloying constituents) recovered in 1943 almost doubled the 6,238 tons reclaimed from purchased scrap in 1942 and was more than six times the quantity recovered in 1941. The value of secondary magnesium totaled $4,798,803 computed at 21.04 cents a pound in 1943 and $2,794,624 computed at 22.4 cents a pound in 1942.

As in the previous year, recovery of magnesium from old scrap amounted to only 1 percent of the total because objects for which magnesium was used had not yet started to return as old scrap to any appreciable extent.

Magnesium was recovered from purchased scrap as secondary magnesium ingot or blended with primary magnesium at 10 plants representing 8 concerns, and secondary magnesium was recovered by direct use in castings at 8 foundries, 6 of them operated by the American Magnesium Corporation. Altogether, 35 plants of various types reported consumption of a total of 13,909 tons of magnesium scrap. Minor uses took only 34 tons of recoverable magnesium, consumed in zinc alloys, in fluxing compounds, in metallurgical processing, in the Grignard reaction, and for production of magnesium nitrate and chloride.

Secondary magnesium recovered in the United States, 1942–43, in short tons

Type of product or use	1942	1943
Magnesium-alloy ingot[1] (gross weight)	6,045	11,009
Magnesium-alloy castings (gross weight)	93	327
In aluminum alloys	46	34
In lead alloys	2	
In zinc alloys	1	1
Consumed in chemical and metallurgical processes	51	33
	6,238	11,404
From new scrap	6,151	11,254
From old scrap	87	150

[1] Includes secondary magnesium incorporated in primary magnesium ingot.

Of the 13,909 short tons of purchased magnesium scrap consumed, 1,295 tons consisted of solid scrap and 12,614 tons consisted of borings, grindings, and dross, with borings the major item. Owing to the fire hazard presented by storage and the contamination of sand and iron that interfered with remelting, large quantities of magnesium sawings and grindings were burned or otherwise disposed of without recovery.

Stocks and consumption of magnesium scrap in the United States in 1943, gross weight, in short tons

	On hand—		Consumption during 1943
	Dec. 31, 1942	Dec. 31, 1943	
Cast scrap	9	32	1,152
Solid wrought scrap	8	14	143
Borings, grindings, drosses, etc	215	279	12,614
	232	325	13,909

The Government control of magnesium, including scrap and secondary metal, was continued in 1943 with only minor changes. Sales of magnesium scrap could be made only to primary producers or a list of six approved secondary remelters, except under specific authorization. According to an order effective December 31, 1942, segregation of magnesium scrap by alloy type was required at the source of generation, and maximum prices for scrap and remelt magnesium ingot were scheduled on January 20, 1943.

New segregated solids were exempt from ceilings, but segregated borings had a maximum price of 9 cents a pound, with mixed borings at 8 cents and mixed solids at 12 cents. The ceiling on Class A remelt magnesium ingot was 21.5 cents a pound. On June 26, 1943, dealers who previously had been at a loss as to how to assist their regular scrap suppliers to dispose of magnesium scrap were allowed to accept a service charge for picking up and loading it on railroad cars, the charge to be subtracted from the price paid by the buyer.

SECONDARY COPPER AND BRASS

Recovery of secondary copper totaled 1,086,047 short tons valued at $256,307,092 in 1943 compared with 927,755 tons valued at $218,950,180 in 1942. The value of copper has remained at 11.8 cents a pound for the last 3 years.

Contrary to all expectations, recovery of copper from old scrap did not decrease in 1943 but amounted to 427,521 tons, almost the same as the 427,122 tons recovered in 1942. The factors contributing to the maintenance of the flow of old copper and brass scrap included the replacement of copper bus bars in aluminum reduction plants by silver, the enforced sale of excess or idle inventories of copper and brass stock shapes, and the return of used matériel, notably fired cartridge cases.

Secondary copper recovered in the United States, 1942–43, in short tons

Secondary copper recovered			Recoverable copper content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As unalloyed copper:			New scrap:		
At primary plants	85,143	122,464	Copper-base	492,392	643,623
At other plants	29,504	15,419	Aluminum-base	7,389	13,348
			Nickel-base	851	1,555
	114,647	137,883	Tin-base	1	----------
In brass and bronze	779,062	912,782		500,633	658,526
In alloy iron and steel	1,164	1,021			
In aluminum alloys	13,894	19,396	Old scrap:		
In other alloys	1,533	1,946	Copper-base	424,441	425,264
In chemical compounds	17,455	13,019	Aluminum-base	1,973	1,664
			Nickel-base	633	409
	813,108	948,164	Tin-base	75	184
	927,755	1,086,047		427,122	427,521
				927,755	1,086,047

The unsurpassed production of munitions brought about a 32-percent rise in the recovery of copper as metal and in alloys from new scrap, from 500,633 short tons in 1942 to 658,526 tons in 1943. This total was more than four times the recovery from new scrap in 1939, when the influence of war had not been felt by our manufacturers.

The production of refined copper (electrolytic grade) from scrap rose to 128,836 short tons in 1943 from 102,975 tons in 1942, the increase being attributed to greater supplies of low-grade copper-bearing residues, such as brass ashes, and to a surplus of contaminated yellow brass that could not be used for brass ingot, and was therefore refined for its copper. Of the 11 refineries using scrap, 9 were well-known primary producers. Total recovery of unalloyed copper from scrap increased from 114,647 tons in 1942 to 137,883 tons in 1943.

Analysis and production of secondary copper and copper-alloy products in the United States, 1942–43

Item produced from scrap	Approximate analysis (percent)						Gross weight produced (short tons)	
	Cu	Sn	Pb	Zn	Ni	Al	1942	1943
Refined copper (electrolytic grade)	100						102,975	128,836
Casting copper	99						7,938	2,938
Copper sheet, rod, tubing, etc	99						724	1,586
Copper powder	98						1,165	1,523
Copper castings	98						1,845	3,000
Total unalloyed copper products							114,647	137,883
Brass and bronze ingots:								
Tin bronze	88	10		2			63,333	71,145
Leaded-tin bronze	88	6	1.5	4.5			59,385	66,822
Leaded red brass	85	5	5	5			98,405	134,241
Leaded semired brass	81	3	7	9			19,323	31,753
High-leaded-tin bronze	80	10	10				26,032	25,701
Do	84	6	8	2			10,329	16,877
Do	75	5	20				5,717	5,631
Leaded yellow brass	66	1	3	30			30,401	18,958
Manganese bronze	62			27		5	[1] 68,627	74,053
Aluminum bronze	89					10	10,038	9,836
Nickel silver	58	2	7	18	14		533	982
Do	65	4	3	5	22		579	1,858
Gilding metal	95			5			347	
Low brass	80			20			1,310	1,891
Silicon bronze	92			4			1,979	5,278
Conductor bronze	94	2	2	2			1,529	1,682
Hardeners and special alloys	81						4,793	21,477
Total copper-alloy ingots							402,660	488,185
Brass-mill billets made by ingot makers								33,449
Brass and bronze sheet, rod, tubing, etc							[2] 531,159	[2] 605,009
Brass and bronze castings							[3] 111,631	[3] 109,472
Copper in chemical products (content)							17,455	13,019

[1] Includes 24,055 tons of ingot formerly classified as high-strength yellow brass.

[2] Gross weight of secondary brass and bronze in commercial shapes; included 370,837 tons of copper, 379 tons of nickel, 5,489 tons of lead, 273 tons of tin, 154,107 tons of zinc, 72 tons of aluminum, and 2 tons of antimony in 1942, and 422,818 tons of copper, 246 tons of nickel, 4,390 tons of lead, 282 tons of tin, 177,255 tons of zinc, and 18 tons of aluminum in 1943.

[3] Gross weight of secondary brass and bronze castings; included 95,224 tons of copper, 602 tons of nickel, 7,235 tons of lead, 5,389 tons of tin, and 3,181 tons of zinc in 1942, and 91,548 tons of copper, 18 tons of nickel, 7,840 tons of lead, 5,838 tons of tin, and 4,228 tons of zinc in 1943.

Commercial production of brass and bronze ingot rose to 488,185 short tons (gross weight) in 1943 compared with 402,660 tons in 1942. The copper content of brass ingot made in 1943 was 398,451 tons, of which 12,505 tons came from refined copper and the balance directly from scrap. Shipments of ingot totaled 494,370 tons, causing producers' stocks to fall from 15,356 tons (revised) at the beginning of the year to 9,171 tons on December 31, 1943. There were 75 plants producing brass ingot for sale in 1943, and 3 foundries made ingot for their own use. Copper shot and nickel-copper alloys were made at 2 additional plants that did not produce brass.

The melting capacity of brass mills was overtaxed during part of the year, and arrangements were made to have brass mill billets and cakes poured from scrap melts at 10 brass ingot plants. These smelters produced 25,991 tons of yellow rod brass, 4,305 tons of yellow brass, 1,683 tons of manganese bronze, 957 tons of gilding metal, 274 tons of tin bronze, 226 tons of aluminum bronze, and 13 tons of special alloys for shipment to brass rolling mills.

Brass mills recovered 1,586 tons of unalloyed copper products and 605,009 tons of brass and bronze sheet, rod, tubing, and other shapes from purchased scrap at 37 plants during 1943. As manufacturers were required to segregate "brass mill" scrap and to return it either directly or through a dealer to the brass mills, the condition of scrap as received at the mills was better than usual, and little difficulty was encountered in consumption of the huge volume of new scrap very nearly as rapidly as it was generated.

Foundries produced 109,472 tons of brass and bronze castings from purchased scrap, more than half this total consisting of railroad bearings made from scrap supplied by the railroads upon a toll basis.

Consumption of purchased copper scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Brass mills		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
No. 1 wire and heavy	19,829	58,152	11,119	3,501	2,591	17,644	112,836
No. 2 wire, mixed heavy, and light	17,471	63,906	16,766	1,761	1,668	8,946	110,518
Composition or red brass	75,835	78,735			20,714	25,499	200,783
Railroad-car boxes	5	1,228				36,695	37,928
Yellow brass	72,304	143,303	508,046	11,401	1,327	3,271	739,652
Cartridge cases	52	31,002		15,654		164	46,872
Auto radiators (unsweated)		25,412				434	25,846
Electrotype shells		2,158				546	2,704
Bronze	10,846	8,995	5,473	92	334	1,824	27,564
Nickel silver	1,144	1,638	1,297	4	31	13	4,127
Low brass	18,118	25	33,204	1,254	428	5,485	58,514
Aluminum bronze	191	219	17		5,045	80	5,552
High-lead brass						274	274
Low-grade scrap and residues	133,616	26,752			285		160,653
	349,411	441,525	575,922	33,667	32,423	100,875	1,533,823

Consumption of purchased copper and brass scrap totaled 1,533,823 short tons, gross weight, in 1943 compared with 1,308,782 tons in 1942. Refineries and brass ingot makers together increased their consumption 27 percent to 790,936 tons, and brass mills raised their 1942 record 11 percent to 609,589 tons, but the 754 foundries and other manufacturers that used purchased copper and brass scrap dropped their consumption 2 percent to 133,298 tons in 1943. Remelting of fired cartridge cases rose from approximately 8,000 short tons in 1942 to 46,872 tons in 1943. Brass mills used one-third of this total and began to increase their purchases early in 1944. Most fired shell cases larger than 40 mm. were resized and reloaded, while smaller sizes were scrapped.

Except for scrap obtained from our own training camps or from naval vessels returning to home ports, there was little opportunity for used war matériel to be made available for recovery during 1943. Supply ships unloading near battle areas could not often wait to be loaded with bulky scrap for the return trip, although the end of the North African campaign provided a lull during which 264 tons of copper and brass scrap were sent back, along with 48,069 short tons of iron and steel and 2,921 tons of other nonferrous scrap, before the end of the year.

Although the return of yellow brass cartridge cases from sea actions started without much delay as the war developed, unalloyed copper and tin bronze were mostly installed in types of service that might take years to reach the scrap stage. Small bronze parts in guns, trucks, and tanks, and copper-base ship fittings are thus not expected to return as scrap for some time.

Throughout the year there was never enough unalloyed copper scrap or red brass and bronze scrap to meet demand. Many ingot makers found it expedient to process low-grade scrap in cupolas to make a stock alloy similar to black copper to be used in lieu of scarce red brass scrap, and a number of small metal-concentrating plants sprang up to recover the metallics from foundry skimmings for use in ingot rather than for refining. After most of the excess and obsolete inventories of copper and brass stock reported by manufacturers had been sold to war industries that could use them, 10,575 tons of these materials were allocated to ingot makers to help alleviate the shortage of scrap. At the end of September the Ordnance Department started selling gilding-metal clips to ingot makers at less than ceiling prices; nevertheless, 12,505 tons of refined copper, 8,643 short tons of pig tin, and lesser quantities of other refined metals were needed to fill material requirements for ingot.

Consumers' stocks of purchased copper-base scrap in the United States at end of year 1942–43, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1942[1]	Dec. 31, 1943
Unalloyed copper	9,235	10,255
Copper-base alloy	75,111	52,658
Low-grade scrap and residues	34,924	38,804
	119,270	101,717

[1] Revised figures.

Scrap consumers' stocks of copper and brass scrap dropped 15 percent from 119,270 tons (revised) at the beginning of the year to 101,717 tons on December 31, 1943.

Scrap-metal dealers supplied 496,943 tons of copper and brass scrap to consumers during 1943, just 2 percent more than the year before. Stocks of copper-base scrap in dealers' yards dropped 11 percent, from 54,815 tons on hand January 1, 1943, to 48,640 tons on December 31, 1943. There were approximately 4,500 scrap dealers whose monthly transactions in nonferrous scrap averaged more than 3 tons per month, but about 2,200 of these conducted 95 percent of the business.

Ceiling prices for brass and bronze ingots were continued throughout 1943 at the level fixed on August 19, 1942, with 85–5–5–5 at 12.25 cents a pound, 88–10–2 at 16.50 cents, 80–10–10 at 14.25 cents, and yellow brass at 10.00 cents a pound delivered in carlots. Including 4 types added to the list on February 1, 1943, 84 specific alloys of brass and bronze ingot were covered by the formal price order.

Maximum prices that could be paid for copper and brass scrap were carried into 1943 at the levels set on August 17, 1942, but 16 additional classes of scrap were added to the formal list on March 20, 1943, and 2 more on June 10, 1943, bringing the total number of specific kinds or grades other than "brass-mill scrap" to 46 for the balance of the year. Ceiling prices for the basic scrap items were unchanged, with No. 1 wire and heavy copper at 9.75 cents a pound, No. 2 wire and mixed heavy copper at 8.75 cents, No. 1 composition at 9.00

cents, and old rolled (yellow) brass at 7.75 cents a pound f. o. b. Scrap generated from the use of brass stock produced by brass mills was officially designated as "brass mill scrap," and maximum prices were first established on June 18, 1941. In 1943 the list contained 32 different classes, with a separate price within each class for clean heavy scrap, rod ends, and clean turnings. In general, brass mill scrap could be sold only to dealers or to brass mills. Plain heavy copper scrap falling within the brass mill group could be sold at 10.25 cents a pound, and yellow brass clips at 8.62 cents a pound f. o. b.

Dealers' buying prices[1] for copper-base scrap held at reasonable levels below ceilings, with monthly average quotations at New York for No. 1 copper scrap maintained throughout both 1942 and 1943 at 9.37 cents a pound. Prices for No. 1 composition scrap were quoted at 8.87 cents a pound all through 1943 compared with the year's average of 8.82 cents in 1942.

Complete allocation of all copper and copper-base materials, including scrap, to each specific use was continued in 1943 without much change from the controls in force at the end of 1942. Copper-base scrap could be sold only to dealers, brass mills, or consumers who had allocation certificates authorizing the purchase of such materials within prescribed quantity limits. The use of copper in any form was absolutely prohibited for many items, and relaxation of stringent conservation did not begin to appear until the second quarter of 1944.

Brass and copper scrap imported into and exported from the United States, 1942–43, in short tons

	1942	1943
Brass scrap imported	[1] 10,519	7,401
Scrap copper imported	912	3,002
Brass scrap exported	168	6
Scrap copper exported	[1] 1,215	443

[1] Revised figures.

SECONDARY NICKEL

The recoverable nickel content of nonferrous scrap used in 1943 totaled 6,917 short tons valued at $4,841,900 compared with 4,142 tons valued at $2,899,400 in 1942. As in the previous 2 years, the value was computed at 35.0 cents a pound, the spot-delivery price of electrolytic nickel, including duty.

Secondary nickel (nonferrous) recovered in the United States, 1942–43, in short tons

Secondary nickel recovered			Recoverable nickel content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As metal	90	796	New scrap:		
In nickel-base alloys	2,230	2,705	Nickel-base	1,698	4,385
In copper-base alloys	1,470	2,096	Copper-base	732	673
In cast iron [1]	114	522			
In chemical compounds	238	798		2,430	5,058
	4,142	6,917	Old scrap:		
			Nickel-base	1,373	1,215
			Copper-base	339	644
				1,712	1,859
				4,142	6,917

[1] Includes only nonferrous nickel scrap added to cast iron.

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[1] Quoted from the American Metal Market.

Recovery of nickel as metal increased from 90 tons in 1942 to 796 tons in 1943, and the production of secondary monel-metal pig and shot went up from 2,564 tons in 1942 to 3,336 tons in 1943, whereas production of secondary copper-nickel pig and shot dropped from 1,154 tons averaging 40 percent nickel in 1942 to 875 tons averaging 46 percent nickel in 1943. Increases in nickel recovery from nonferrous scrap resulted mostly from the greater use of nickel residues and the expanded supply of new monel-metal clippings. Consumption of nonferrous nickel-bearing scrap rose to 14,409 short tons gross weight in 1943 compared with 7,908 tons in 1942. Scrap-metal dealers shipped 5,158 tons of scrap nickel and monel to consumers in 1943 compared with 3,297 tons in 1942. Dealers' stocks of nickel-base scrap varied only from 911 tons on hand January 1, 1943, to 811 tons on December 31, 1943, but consumers' stocks of purchased nickel-bearing scrap fell from 2,515 tons (revised) to 1,509 tons on these respective inventory dates.

Consumption of purchased nickel scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Pure nickel	268	35	147	255	705
Monel metal	4,184	1,034	320	142	5,680
Nickel silver	1,144	1,638	1,328	17	4,127
Miscellaneous nickel alloys	10	18	8	10	46
Nickel residues	3,109	194	359	189	3,851
	8,715	2,919	2,162	613	14,409

Primary nickel was put under complete allocation on May 15, 1941, and use of the metal in many items was prohibited after April 1, 1942, to conserve secondary nickel and nickel of any sort in fabricators' inventories. Segregation of all scrap containing nickel was ordered on April 24, 1942. Restrictions were tightened again on October 2, 1942, limiting the use of nickel in any form to implements of war, with a few specific exceptions. Even the use of nickel in coinage was stopped in September 1942, and a new alloy containing 35 percent silver, 56 percent copper, and 9 percent manganese was used thereafter in the familiar 5-cent piece. Control of nickel in its nonferrous applications was continued throughout 1943 without changes of any importance.

Maximum prices for nickel scrap remained as they had been set on June 2, 1941, with pure nickel scrap at 26 cents a pound and new monel-metal clippings at 20 cents a pound. Dealers' buying prices for nickel clips in New York were quoted at 21.00 cents a pound from the beginning of 1943 until the first week of November, then dropped to 20.00 cents for the remainder of the year, and monel clips were steady all year at 16.00 cents a pound. The average price of nickel clips in 1943 was 20.83 cents a pound compared with 23.00 cents in 1942, and monel clips averaged 16.00 cents in 1943 compared with 17.00 cents in 1942.

No imports of nickel-bearing scrap were reported, but exports totaled 5,633 short tons in 1943 and 4,498 tons in 1942.

Consumers' stocks of purchased nonferrous nickel scrap[1] *in the United States at end of year, 1942–43, gross weight, in short tons*

Scrap item	On hand—	
	Dec. 31, 1942[2]	Dec. 31, 1943
Unalloyed nickel	125	139
Nonferrous nickel alloys	1,863	1,108
Nickel residues	527	262
	2,516	1,509

[1] Includes nickel-silver scrap.
[2] Revised figures.

SECONDARY LEAD

The secondary-lead industry improved in 1943, with 341,243 short tons of lead valued at $43,679,104 recovered compared with 323,001 tons valued at $40,698,126 in 1942, but activity was still 56,000 tons below the 1941 record. Values were computed at 6.4 cents a pound in 1943 and 6.3 cents a pound in 1942. Production of soft lead from scrap dropped 15 percent to 58,591 tons compared with 68,870 tons in 1942, but the secondary-lead content of antimonial lead rose 3 percent to 176,076 tons in 1943 in contrast with 170,559 tons in 1942. Secondary lead recovered in solder rose 90 percent—from 17,611 tons in 1942 to 33,529 tons in 1943—while the secondary-lead content of type-metal production remained almost the same, at 23,201 tons in 1943 compared with 23,741 tons in 1942. An additional 1,489 tons of scrap type metals were withdrawn from circulation and separated into antimonial lead (1,398 tons) and tin (45 short tons) in the tin-conservation program supported by the Metals Reserve Company.

Secondary lead recovered in the United States, 1942–43, in short tons

Secondary lead recovered			Recoverable lead content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As metal:			New scrap:		
At primary plants	12,856	21,634	Lead-base	8,569	22,361
At other plants	55,746	36,688	Copper-base	5,844	9,030
	68,602	58,322		14,413	31,391
In antimonial lead[1]	170,559	176,076	Old scrap:		
In other lead alloys	58,834	76,474	Battery-lead plates	159,868	152,649
In copper-base alloys	24,518	28,625	All other lead-base	131,456	140,709
In tin-base alloys	488	1,746	Copper-base	16,900	16,455
			Tin-base	364	39
	254,399	282,921			
				308,588	309,852
	323,001	341,243			
				323,001	341,243

[1] Includes 11,561 tons of lead recovered in antimonial lead from secondary sources at primary plants in 1942 and 6,722 tons in 1943.

Production of secondary lead, tin, and lead- and tin-alloy products in the United States in 1943, gross weight, in short tons

	Gross weight of product[1]	Secondary-metal content			
		Lead	Tin	Antimony	Copper
Refined pig lead	43,638	43,638			
Remelt lead	14,906	14,637			
Lead foil	47	47			
	58,591	58,322			
Refined pig tin	5,074		5,065		
Remelt tin	172	10	162		
Tin foil	25		25		
	5,271	10	5,252		
Lead and tin alloys:					
Antimonial lead (to 2 percent antimony)	32,730	32,095	5	630	
Antimonial lead (2 to 4 percent antimony)	45,702	44,216	33	1,453	
Antimonial lead (4 to 8 percent antimony)	40,356	34,916	148	2,316	
Antimonial lead (over 8 percent antimony)	78,804	64,849	80	4,856	
Common babbitt	23,409	18,374	1,584	2,526	134
Genuine babbitt	2,814	492	1,890	234	198
Other tin babbitts	2,691	1,244	1,222	178	47
Solder (to 15 percent tin)	11,060	9,906	964	189	1
Solder (15 to 30 percent tin)	21,893	16,702	3,388	99	3
Solder (over 30 percent tin)	10,364	6,921	2,236	84	5
Linotype metal	7,510	6,259	392	859	
Other type metals	20,190	16,942	796	2,054	
Miscellaneous lead-tin alloys	514	143	366	4	1
	298,037	253,059	13,104	15,482	389
Composition foil	1,271	1,227	43	1	
Tin content of chemical products	250		250		

[1] Difference between gross weight of product and secondary-metal content represents added primary metals or impurity content.

Of the total secondary lead recovered, 315,758 short tons were reclaimed from lead- and tin-base scrap, whereas the remaining 25,485 tons were lead contained in secondary brass and bronze produced by remelting copper-base scrap. A total of 3,140 tons of lead reclaimed from lead-base scrap was added to brass and bronze to bring the total recovery of secondary lead in this type of product to 28,625 tons.

Consumption of purchased lead scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Soft lead		48,779	940	795	50,514
Hard lead		18,763	2	2,132	20,897
Cable lead		17,607		47	17,654
Battery-lead plates		229,059		6	229,065
Mixed common babbitt		8,907		7,486	16,393
Solder and tinny lead	100	13,889	3,656	44	17,689
Type metals		18,321		100	18,421
Dross and residues	24,206	25,474	221		49,901
	24,306	380,799	4,819	10,610	420,534

Consumption of lead-base scrap totaled 420,534 short tons, gross weight, in 1943 compared with 396,531 tons used in 1942. The use of soft lead scrap rose 10,003 tons, of battery-lead plates 7,483 tons, mixed common babbitt 5,382 tons, and solder scrap 6,135 tons; but consumption of type-metal scrap dropped 2,268 tons, and treatment of drosses and residues fell off 7,653 tons. Purchased lead-base scrap was consumed at 290 plants classed as remelters, smelters, or refiners and at 263 plants classed as foundries or other manufacturers. Consumption of lead scrap at plants of remelters and smelters was highest in April, then dropped to the year's low in May and June. Further peaks of activity were noted in August and October, with other months near the average rate.

More secondary lead could have been recovered in 1943, because demand was fairly strong and additional scrap, particularly battery lead, was available for collection, but both dealers and smelters were hampered by lack of manpower. The armed forces and highly paid war industries took heavy toll of the peddlers who normally gathered scrap from farms, households, stores, and garages, and there was the added difficulty of obtaining sufficient gasoline, tires, and parts to keep trucks in continuous operation. Few men could be found to fill the unpleasant job of breaking up old batteries in dealers' yards, particularly in the winter. Occasional reports indicated that primary lead was used by some secondary smelters to fill orders for antimonial lead that ordinarily would have been produced from battery plates if workers had been available.

Pigged percentage metals circulated among remelters and smelters in 1943 totaled 56,853 short tons consisting of 31,500 tons of antimonial lead, 7,873 tons of soft lead, 6,294 tons of solder, 4,465 tons of lead-base bearing metals, 2,848 tons of type metals, 1,757 tons of tin babbitt, 1,671 tons of cable lead, 205 tons of pewter, 181 tons of remelt tin, and 59 tons of tin-bearing lead.

When a new type of monthly survey was applied to the secondary-lead industry, the inventory of lead scrap and residues at smelters, previously reported for December 31, 1942, as 53,460 tons, was revised upward by more exact reporting to 76,171 tons. Improved demand for secondary-lead-base products during 1943 brought stocks of soft lead scrap down from 4,802 tons to 2,459 tons and stocks of lead-base alloy scrap down from 47,280 tons to 37,647 tons on December 31, 1943, but the lack of extra manpower needed to work low-grade materials caused an increase in accumulated stocks of drosses and residues from 24,089 tons to 31,394 tons (gross weight). Total stocks of scrap and residues at remelters' and smelters' plants were reported as 71,500 short tons on December 31, 1943.

Consumers' stocks of purchased lead-base scrap in the United States at end of year, 1942–43, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1942[1]	Dec. 31, 1943
Unalloyed lead	4,802	2,459
Lead-base alloy	47,280	37,647
Drosses and residues	24,089	31,394
	76,171	71,500

[1] Revised figures.

Scrap-metal dealers' stocks of lead-base scrap fell from 37,333 tons on December 31, 1942, to 35,810 tons on December 31, 1943, and shipments of lead scrap from dealers to consumers totaled 279,580 tons in 1943 compared with 306,192 tons in 1942. Movement of scrap through dealer channels was brisk at the beginning of 1943 but dropped month by month to a low point in May, then stayed quite level for the balance of the year, except for a temporary peak in November.

The maximum prices for lead scrap that had been fixed on January 15, 1942, were continued throughout 1943, but effective January 20, 1943, 6 new basing points for determination of prices were added to the list, raising the total number to 152. With the ceiling on primary pig lead at New York fixed at 6.50 cents a pound f. o. b., the comparable price for heavy lead scrap, according to the formula, was the base price of primary lead less 0.55 cent, or 5.95 cents a pound.

Dealers' buying prices for heavy lead scrap in New York averaged 5.37 cents a pound in 1943 compared with 5.49 cents in 1942. There was no change in the monthly average quotation after it dropped to 5.37 cents in August 1942. Dealers' buying prices for battery-lead plates at New York were quoted at 2.75 to 2.87 cents a pound throughout 1943 without change. Since toll agreements for smelting scrap were prohibited except by specific authorization by the Office of Price Administration, battery-plate smelting charges were not regularly quoted.

Both scrap and secondary lead remained subject to allocation by the Government in 1943, but very little interference with free movement was found necessary. Scrap dealers were prohibited from receiving lead scrap unless they had moved, in the preceding 60 days, a quantity at least equal to their inventory at the current date, this regulation having been in effect since May 18, 1942. On January 6, 1943, the quota for production of storage batteries was raised from 90 to 100 percent of 1941 production, and on May 26, 1943, the 90-percent limitation on use of lead in essential items was removed, and a few additional uses of lead were permitted. These changes improved the market for secondary lead.

Imports of lead scrap totaled 496 short tons in 1943 compared with 1,305 tons in 1942 and no exports were recorded in 1943 compared with 26 tons listed in 1942.

SECONDARY TIN

Secondary tin recovered from scrap in 1943 totaled 37,820 short tons valued at $39,332,800 compared with 37,918 short tons valued at $39,434,720 in 1942. The value was computed at 52.0 cents a pound in both years.

Detinning plants produced 4,327 short tons of pig tin from new tinplate clippings and old cans, and 900 short tons (tin content) of secondary pig tin and 25 tons of tinfoil were produced at various plants from tin-base scrap and residues. The total recovery of unalloyed tin from scrap was 5,252 short tons in 1943 compared with 5,799 tons in 1942. Recovery of secondary tin in solder remained almost the same as in the previous year; but tin in tin-base babbitts was almost doubled in 1943, and tin reclaimed in lead-base alloys was virtually cut in half. Owing to the increased use of high-tin bronzes in war applications, the recovery of secondary tin in bronze increased from 17,444 tons in 1942 to 19,171 tons in 1943.

Secondary tin recovered in the United States, 1942–43, in short tons

Secondary tin recovered			Recoverable tin content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As metal:			New scrap:		
At detinning plants	5,261	4,327	Tin plate	4,896	2,591
At other plants	538	925	Tin-base	2,980	2,197
			Lead-base	1,796	1,708
	5,799	5,252	Copper-base	4,385	6,147
In solder	6,579	6,588		14,057	12,643
In tin babbitt	1,597	3,112			
In chemical compounds	303	250	Old scrap:		
In lead-base alloys	6,196	3,447	Tin cans	597	1,986
In brass and bronze	17,444	19,171	Tin-base	3,490	4,795
			Lead-base	7,871	6,542
	32,119	32,568	Copper-base	11,903	11,854
	37,918	37,820		23,861	25,177
				37,918	37,820

Very little block-tin scrap could be found anywhere, and the flow of tin dross and residues was lessened in 1943, but babbitt scrap was available in unusually large quantities. Almost half of the secondary tin reclaimed for use was contained in brass and bronze scrap, and tin-base, lead-base, and tin-plate scrap supplied the remainder, the proportion decreasing in the order given. Type-metal scrap that was available in excess of industrial requirements was treated by the National Lead Co. for the account of the Metals Reserve Company, starting in April 1943, and tin was removed as sodium stannate, then reduced to pig tin at another plant. Only 45 short tons of tin emerged from this process in 1943.

Consumption of purchased tin scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Block-tin pipe, scrap, and foil		737	10	85	832
Tin scruff and dross	2,612		4		2,616
No. 1 pewter		562			562
High-tin babbitt		4,040		82	4,122
Residues	1,376	113			1,489
	3,988	5,452	14	167	9,621

All classes of scrap having any appreciable tin content were in good demand all year, for every effort was made to conserve the dwindling stock pile of imported tin. The surrender of a used collapsible tube when each new tube of toilet preparations was purchased was continued throughout 1943, and the Tin Salvage Institute as agent for the Metals Reserve Company recovered 257 short tons of tin in 1,014 tons of lead-tin alloys from collapsible tubes during the year. Owing to the use of lead-tin composition tubes in place of tin tubes for most applications, the recovery of tin from this source declined rapidly as time went on.

The dealers' buying price for block-tin pipe scrap at New York was quoted at 45.50 cents a pound throughout 1943, as it had been in 1942. Dross and residues of tin, solder, babbitt, and type metals were exempt from price control, and metallic scrap-tin materials were also exempt when sold to dealers or smelters. When sold to an industrial consumer, tin scrap was subject to the provision of the General Metals Price Regulation based upon pre-war sales prices.

Consumers' stocks of purchased tin-base scrap in the United States at end of year, 1942–43, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1942 [1]	Dec. 31, 1943
Unalloyed tin	151	69
Tin-base alloys	682	419
Drosses and residues	1,624	1,387
	2,457	1,875

[1] Revised figures.

Tin scrap was subject to allocation whenever necessary, but Government powers were seldom invoked in this regard during 1943. Scrap-metal dealers' inventories were limited by a 60-day turn-over rule and remained low.

Detinning plants.—There were 7 detinning plants in operation in 1943: Johnston & Jennings Co., Metal & Thermit Corporation (3 plants), Standard Metal Refining Co., and the Vulcan Detinning Co. (2 plants). Construction on 10 detinning plants to be built by the Government was halted in February 1943, before actual building had begun, because the available supply of cans was far below existing capacity, but plans for one plant at Birmingham, Ala., were later reinstated. This plant was built during 1943 and was to start operations early in 1944.

Secondary tin recovered at detinning plants in the United States, 1942–43

	1942	1943
Scrap treated:		
Clean tin plate ... long tons	287,660	206,336
Old tin-coated containers ... do	51,721	175,870
	339,381	382,206
Tin recovered as metal:		
New tin-plate clippings ... short tons	4,664	2,432
Old tin-coated containers ... do	597	1,895
Tin content of tin compounds produced ... do	231	250
	5,492	4,577
Weight of tin compounds produced ... do	484	537
Average quantity of tin recovered per long ton of clean tin-plate scrap used ... pounds	34.03	25.12
Average quantity of tin recovered per long ton of old tin-coated containers used ... do	23.06	22.58
Average delivered cost of clean tin-plate scrap ... per long ton	$18.97	$16.62
Average delivered cost of old tin-coated containers ... do	$12.37	$13.88

Although most large municipalities were ordered to collect used cans that had been washed and flattened for shipment to detinning plants, the public response to appeals for cooperation in preparing the cans was disappointing in many localities. Only 175,870 long tons of old tin-coated containers were made available for detinning, and part of this quantity consisted of unprepared cans put through shredding plants. Prepared cans from Army depots comprised almost one-fifth of the total.

The substitution of electroplating for hot dipping of tin plate in a number of plants brought about a decline in the average quantity of tin recovered per long ton of clean tin-plate scrap, from 34.03 pounds in 1942 to 25.12 pounds in 1943. The effect of the reduced thickness of tin coating was not so well-marked in old cans, owing to the time lag before canned goods reached the ultimate consumer, and recovery dropped only from 23.06 pounds to 22.58 pounds of tin per long ton of cans treated.

Imports of tin-plate scrap totaled 19,591 long tons compared with 24,082 long tons in 1942. Exports of tin-plate scrap, circles, wastewaste, and clippings dropped to 1,740 long tons contrasted with 4,639 long tons in 1942 and 14,168 long tons in 1941.

SECONDARY ANTIMONY

Recovery of secondary antimony in lead-base and tin-base alloys totaled 15,483 short tons valued at $4,929,787 in 1943 compared with 18,200 tons valued at $5,663,840 in 1942. The value was computed at 15.92 cents a pound—the average selling price for ordinary brands of American-grade antimony in 1943—and at 15.56 cents a pound in 1942.

Secondary antimony recovered in the United States, 1942–43, in short tons

Secondary antimony recovered			Recoverable antimony content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
In antimonial lead	11,943	9,255	New scrap:		
In other lead alloys	6,019	5,444	Lead-base	(1)	62
In tin-base alloys	201	784	Tin-base	3	
In copper-base alloys	37				
				3	62
	18,200	15,483	Old scrap:		
			Lead-base	18,017	15,109
			Tin-base	180	312
				18,197	15,421
				18.200	15,483

[1] Less than 1 ton.

The maximum antimony content of battery grids had been limited to 7.5 percent in the first half of 1942, and apparently this contributed to the drop in recovery of antimony from old battery-lead plates to 7,215 tons during 1943 compared with 10,237 tons reclaimed from this source in 1942. Recovery of antimony from other classes of scrap, such as bearing metals, type metals, and drosses, increased 305 tons in 1943. Remelters and smelters recovered 92 percent of the secondary antimony, and the other 8 percent was reclaimed by bearing manufacturers. Consumption of purchased scrap from which antimony was recovered may be found in lead-base and tin-base scrap-consumption tables in the sections of this chapter devoted to those metals, and products in which secondary antimony was recovered are included in the lead- and tin-products table. As far as could be determined, all antimony recovered from scrap remained in the alloyed state, and none was recovered as unalloyed metal or in chemical compounds.

The maximum allowable antimony content of storage battery grids was raised from 7.5 to 12 percent on August 8, 1942, but on March 8, 1943, all limitations on the antimony content of alloys were removed. Allocation of antimony to consumers was started May 1, 1942, and ended at the close of 1943.

The ceiling price for antimony in alloy metals or metallic scrap remained at 15.50 cents a pound of contained antimony, this ceiling having been last adjusted April 1, 1942, but there was no regulation of prices for antimony in drosses or other residues. The prices of primary antimony had been voluntarily held down by producers and importers since March 1942 at the request of the Government, but formal ceilings at the same level were established on December 4, 1943.

The maximum price for standard-grade antimony, 99 to 99.8 percent pure, was fixed at 14.50 cents a pound at Laredo, Tex.

SECONDARY ZINC

Secondary zinc recovered in 1943 from purchased scrap totaled 368,488 tons with a value of $63,379,936 calculated at 8.6 cents a pound, the average selling price for the year of all grades of refined zinc. This total was 11 percent higher than in 1942, when 330,526 tons with a value of $57,511,524 at 8.7 cents a pound were recovered.

Secondary zinc recovered[1] in the United States, 1942–43, in short tons

Secondary zinc recovered			Recoverable zinc content of scrap		
Form of recovery	1942	1943	Kind of scrap processed	1942	1943
As metal:			New scrap:		
By distillation:			Zinc-base	95,296	94,845
Slab zinc	52,712	47,791	Copper-base	162,242	189,414
Zinc dust	17,685	22,336	Aluminum-base	1	4
By remelting	11,048	8,765			
				257,539	284,263
	81,445	78,892	Old scrap:		
In zinc-base alloys	3,670	4,808	Zinc-base	29,200	29,588
In brass and bronze	212,038	253,082	Copper-base	43,787	54,637
In aluminum-base alloys	18	96			
In chemical products:				72,987	84,225
Zinc oxide	4,373	5,375			
Zinc sulfate	2,150	2,707		330,526	368,488
Zinc chloride	10,815	11,104			
Lithopone	15,750	11,110			
Miscellaneous	267	1,314			
	249,081	289,596			
	330,526	368,488			

[1] Zinc content.

There was a 19-percent rise in the secondary zinc recovered from purchased scrap in brass and bronze products, a 26-percent gain in the secondary zinc in zinc dust, and smaller gains in the secondary-zinc content of zinc-base alloy products and most pigments and salts. The recovery of secondary zinc in lithopone fell 29 percent but was still higher than in any of the other zinc-chemical products. Of the 253,082 tons of secondary zinc recovered in brass and bronze, only 9,031 tons came directly from zinc-base scrap, the remainder being reclaimed from brass scrap. The increased recovery of zinc in new brass scrap, from 162,242 tons in 1942 to 189,414 tons in 1943, resulted mostly from the expanded ammunition program, whereas the increase in zinc recovered in old brass scrap, from 43,787 tons in 1942 to 54,637 tons in 1943, was attributed to the remelting of fired cartridge cases.

Production of secondary-zinc and zinc-alloy products in the United States, 1942–43, gross weight, in short tons

Products	1942	1943
Redistilled slab zinc	53,195	48,215
Zinc dust	18,101	22,788
Remelt spelter[1]	8,637	7,406
Remelt die-cast slab	2,488	2,641
Zinc-die and die-casting alloys	1,403	2,617
Galvanizing stock	683	591
Rolled zinc	1,958	909
Zinc in chemical products	33,355	31,610

[1] Includes small tonnages of zinc anodes.

Total production of redistilled slab zinc, 48,215 tons, represented a 9-percent decline from the 1942 total, but 22,788 tons of zinc dust were produced from scrap in 1943—an increase of 26 percent over the 1942 output. Zinc dust made from scrap amounted to 87 percent of the total production from all sources. The increased recovery of secondary zinc in dust almost counterbalanced the decline in redistilled slab, the total redistilled production for 1943 amounting to 71,003 tons compared with 71,296 tons in 1942. Twenty-four distillers used zinc scrap in 1943, and of these 14 made only redistilled slab, 4 made only dust, and the other 6 made both. Four plants that had been active as redistillers in 1942 showed no production of either redistilled slab or dust in 1943. Of these, 1 had been a dust producer and 3 had made slab zinc.

Other metallic zinc products reclaimed from scrap in 1943 dropped to 14,164 tons compared with 15,169 tons in 1942 as a result of declines of 1,231 and 1,049 tons, respectively, in the production of remelt spelter and rolled zinc, partly counterbalanced by increases in the output of remelt die-cast slab and zinc die and die-casting alloys made from scrap. A considerable quantity of a new type of scrap from the manufacture and use of zinc-alloy forming dies entered the industry in 1943 and was reused in further production of zinc dies. Another new type of scrap consisted of turnings from the production of zinc-alloy screws, and this scrap was also remelted and returned to its original application.

Although the trend of zinc chemical production increased throughout 1943, the 31,610 tons of secondary zinc recovered in pigments and salts at 60 chemical plants were 1,745 tons less than in 1942 and 16,894 tons (35 percent) less than the 48,504 tons recovered in 1941. Most of the zinc sulfate and chloride and nearly all the zinc dust produced in the country are made from scrap, but most lead-free zinc oxide and most lithopone are made from other raw materials, such as ore, by-product residues from ore treatment, refined zinc, remelt spelter, and remelt die-cast slab.

In addition to the distillers and chemical works that recovered secondary zinc, 122 remelters, including brass-ingot makers, zinc smelters, and scrap-metal dealers, and 110 foundries and other manufacturers consumed purchased zinc scrap in 1943.

Consumption of purchased zinc scrap in the United States in 1943, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Clippings	3,901		1,142		5,043
Sheet and strip		6,928		340	7,268
Engravers' plates		2,875		212	3,087
Skimmings and ashes	41,388		22,949		64,337
Dross	43,610		284		43,894
Die castings and other alloyed zinc	3,201	10,934	93	170	14,398
Flue dust and residues	12,024	11,908	12,551	11,242	47,725
	104,124	32,645	37,019	11,964	185,752

Consumption of zinc-base scrap in 1943 was 185,752 tons—4,922 more than in 1942—but the consumption of all types of scrap except flue dust and residues decreased, and the latter two types together gained 11,903 tons. The declining trend in consumption of solid-metal scrap was more pronounced in the latter half of the year than in the first half, but use of drosses and residues increased at a steady rate throughout the year. Although only 16 percent of the total weight of zinc-base scrap processed in 1943 was solid metal and 84 percent drosses, skimmings, flue dust, and other residues, three-fourths of the zinc recovered from zinc-base scrap emerged in metal products and only 25 percent in zinc chemical form. Results of a special study of the distribution of zinc scrap in December 1943 indicated that consumption of metallic zinc scrap was concentrated in the areas surrounding New York and Chicago and less than 10 percent was used throughout the rest of the country. About one-third of the total metallic zinc scrap handled by dealers was gathered in 6 States in the general vicinity of New York and Philadelphia, and another third in 7 States surrounding Chicago. The balance of the metallic zinc scrap reported by dealers was scattered among 35 States, with only California and Texas showing any considerable collection.

Consumers' stocks of purchased zinc-base scrap in the United States at end of year, 1942–43, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1942	Dec. 31, 1943
Metallic zinc scrap	2,960	3,574
Dross	4,232	6,579
Skimmings and residues	34,625	27,485
	41,817	37,638

Nonferrous-scrap-metal dealers' shipments of zinc-base scrap and residues to consumers totaled 50,435 tons in 1942 but only 44,483 tons in 1943, having exhibited a declining trend throughout most of the latter year. Of this total, 25,753 tons were metallic scrap, which represented 81 percent of all the metallic scrap used by consumers of zinc-scrap. Only 12 percent of the drosses and residues purchased by scrap users was furnished by dealers, the remainder having been shipped directly to smelters from the plants where it was generated.

On March 18, 1943, the Office of Price Administration effectuated amendments to maximum price regulations to equalize prices for less-than-carlots of secondary slab zinc at the prices for carlots. The new regulation also provided that secondary slab of lower grade than Prime Western should be sold at prices under the maximum for that grade. The maximum base price for Prime Western secondary slab zinc during 1943 was 8.25 cents a pound. Ceiling prices for zinc scrap remained unchanged in 1943, with new clippings at 7.25 cents and old zinc at 5.75 cents a pound, but dealers' buying prices edged slightly lower during the year and were always 1.50 to 3.30 cents lower than the ceilings. At New York dealers' buying prices for new zinc clippings averaged 5.88 cents a pound during 1943 and ranged from a high of 6.00 cents in January and February to a low monthly average of 5.65 cents a pound in December. The average monthly price for old zinc scrap was 4.12 cents a pound throughout the year.

Imports of old zinc scrap into the United States amounted to 114 tons in 1943 compared with 143 tons in 1942. Drosses and residues imported totaled 5,032 tons in 1943, a rise of 1,833 tons from the 3,199 tons imported in 1942. Large quantities of fume from a primary smelter in Canada were imported by one company for the manufacture of zinc sulfate, but the zinc reclaimed from this material was not counted as secondary zinc.

MAXIMUM PRICES FOR CERTAIN SCRAP METALS

COPPER AND BRASS SCRAP

(Set by OPA; Effective June 10, 1943)

The following are maximum prices, f. o. b. freight cars, trucks or other means of transportation at the point of shipment and include all commissions and service charges:

Item No.	Grade of scrap	Maximum price per pound of material (cents)
1.	No. 1 copper wire and No. 1 heavy copper	9.75
1.	No. 1 tinned copper wire and No. 1 tinned heavy copper	9.75
1.	No. 2 copper wire and mixed heavy copper	8.75
1.	Copper tuyeres	8.75
1.	Light copper	7.75
1.	Copper borings	9.75
1.	Lead covered copper wire and cable	([1])
1.	Insulated copper	([2])
2.	Bell metal	15.50
2.	High grade bronze gears	13.25
2.	High grade bronze solids	([3])
2.	High grade—low lead bronze borings	([4])
2.	Babbitt lined brass bushings	13.00
2.	High lead bronze solids	([5])
2.	High lead bronze borings	([6])
2.	Red trolley wheels	10.75
2.	Tinny bronze (phosphor bronze) solids	10.50
2.	Tinny bronze (phosphor bronze) borings	10.50
2.	Copper nickel solids and borings	9.25
2.	Bronze paper mills wire cloth	9.50
2.	Aluminum bronze solids	9.00
2.	Soft red brass (No. 1 composition)	9.00
2.	Soft red brass borings (No. 1 composition borings)	9.00
2.	Contaminated gilding metal turnings	8.50
2.	Unlined standard red car boxes	8.25
2.	Lined standard red car boxes	7.75
2.	Cocks and faucets	7.75
2.	Mixed brass screens	7.75
2.	Red brass breakage (irony composition)	7.50
2.	Old nickel silver solids	6.25
2.	Old nickel silver borings	6.25
2.	Yellow brass castings	5.25
2.	Copper-lead solids	6.25
2.	Copper-lead borings	6.25
3.	Zincy bronze solids	8.00
3.	Zincy bronze borings	8.00
3.	Fired rifle shells	8.25
3.	Brass pipe	8.00
3.	Old rolled brass	7.75
3.	Admiralty condenser tubes	8.00
3.	Muntz metal condenser tubes	7.50
3.	Plated rolled brass sheet, pipe and reflectors	7.50
3.	Manganese bronze solids (0.4% pb. or less)	7.25
3.	Manganese bronze solids (0.41% to 1% pb.)	6.25
3.	Manganese bronze borings (0.4% pb. or less)	6.50
3.	Manganese bronze borings (0.41% to 1% pb.)	5.50
4.	Automobile radiators	7.00
5.	Refinery brass (over 60% cu.)	([7])
5.	Refinery brass (50.01% to 60% cu.)	([8])

[1] (a) Multiply gross weight, less weight of lead covering and any insulation by price for applicable grade of copper wire; (b) divide result by gross weight; and (c) deduct from resulting quotient 0.15c. This is maximum price. In addition payment may be made for lead covering at maximum price established by MPR 70. Maximum price may be determined by applying foregoing to representative sample.

[2] (a) Multiply gross weight less weight of insulation by price for applicable grade of copper; (b) divide result by gross weight; and (c) deduct from resulting quotient 0.15c. This is maximum price. Maximum may be determined by applying foregoing computation to representative sample.

[3] Price shall be determined by application of section 1309.70 (b) (3) of MPR 20 to analysis, other than by inspection, of material. If consumer receives less than 5,000 pounds in a shipment, he may determine by inspection that material meets specifications but in such case, the maximum is 10.75c. In either case, price is subject to 1% deduction for each 1% of dirt, etc.

[4] Price shall be determined by application of section 1309.70 (b) (3) of MPR 20 to wet or natural analysis after button analysis has determined proper classification. If consumer receives less than 2,000 in a shipment at one time, he may determine by inspection that material meets specification but in such case maximum is 10.00c subject to 1% deduction for each 1% of dirt, etc.

[5] Maximum shall be calculated by application of following method to analysis other than by inspection:
1.25% zn or less: cu content x 9.25c + sn content x 33c
1.26% to 4% zn; cu content x 9c + sn content x 32c
4.01% zn or more: cu content x 8.5c + sn content x 30c
However, 0.01c per pound of material shall be added or deducted for each 0.01% antimony below 0.25% or above 0.75%. If consumer receives less than 40,000 pounds in a shipment at one time he may determine by inspection that material meets specifications but in such case maximum is 9.50c. In either case, price is subject to 1% deduction for each 1% of dirt, etc.

[6] Apply same method as for high lead bronze solids to wet or natural analysis after button analysis has determined proper classification of zinc content. If consumer receives less than 5,000 in a shipment at one time, he may determine by inspection that material meets specifications but in such case maximum is 9.25c subject to 1% deduction for each 1% of dirt, etc.

[7] 60.01% dry copper content (61.31% wet assay) times 8.00c.
50.01% dry copper content (51.31% wet assay) times 7.75c.

QUANTITY PREMIUMS.

(i) For shipment at one time of 60,000 pounds or more of only one item other than Item 4 or Item 5—¾c per pound;

(ii) For shipment at one time of 40,000 pounds or more of one or two items—½c per pound.

(iii) For the shipment by one person in one railroad car of 60,000 pounds or more of material eligible for the 0.75 cent per pound premium provided for in subdivision (i) of this paragraph and, in the same railroad car, 20,000 pounds or more of any one other group—0.50 cent per pound for the material composing such other group in addition to 0.75 cent per pound for the 60,000 pound group.

No quantity premium may be added if any special use, briquetting or crucible shape premium has been added to such price.

BRIQUETTING AND CRUCIBLE SHAPE PREMIUMS.

No. 1 copper wire and No. 1 heavy copper	1¼c
No. 1 tinned copper wire and No. 1 tinned heavy copper	1¼c
No. 2 copper wire and mixed heavy copper	1c
Manganese bronze solids	2½c
All other copper alloy scrap	1¼c

Above premiums not applicable on sales to copper refiner or brass and bronze ingot manufacturer.

SPECIAL USE PREMIUMS.

To the maximum price of any grade of copper scrap a special use premium of 1¼c may be added if the material has been prepared to meet the consumer's specifications and is suitable for direct use without further preparation. Not applicable on sales to refinery, ingot maker, foundry or brass mill.

No special use, briquetting or crucible shape premium may be added if any quantity premium has been added.

BRASS-MILL SCRAP

Revised to Oct. 29, 1942, by OPA (f. o. b. shipping point)

	Heavy Scrap	*Rod Ends*	*Turnings*
Copper	10¼	10¼	9½
Tinned copper	9⅝	9⅝	9⅜
Commercial bronze:			
95% or more Cu	9½	9¼	8¾
90% to 95% Cu	9⅜	9⅛	8⅝
Red brass: 80% or more Cu	9⅛	8⅞	8⅜
Best quality brass: 71% to 80% Cu	8¾	8½	8
Yellow brass	8⅝	8⅜	7⅞
Muntz metal	8	7¾	7¼
Nickel silver:			
5% Ni	9¼	9	4⅝
10% Ni	10⅛	9⅞	5 1/16
15% Ni	10⅞	10⅝	5 3/16

Maximums are for shipments of less than 15,000 pounds. For 15,000 to 40,000 pounds add 0.62½c but heavy scrap may not be mixed with rod ends and/or turnings. For over 40,000 pounds add 1.00c for any mixture.

ZINC SCRAP

Established Oct. 17, 1941 by OPA (Per lb. f. o. b. point of shipment)

(Prices are for clean, dry scrap, free of iron and other foreign material).

New zinc clippings and trimmings	7.25c
Engravers' and lithographers' plates	7.25c
Old zinc scrap	5.75c
Unsweated zinc dross	5.80c
Die cast slab	5.80c
New die cast scrap	4.95c
Radiator grilles, old and new	4.95c
Old die cast scrap	4.50c

Premium of 0.50c per pound allowed for shipments at one time of 10,000 pounds of new zinc clippings, engravers' and lithographers' plates and old zinc scrap or any combination of the three; and for shipment at one time of 20,000 pounds of new or old die cast scrap and radiator grilles or any combination of the three. No premium is allowed on galvanizers' dross or die cast slab.

ALUMINUM SCRAP

Revised to Dec. 23, 1943, by OPA (f. o. b. shipping point)

Following are the maximum prices for aluminum scrap (in cents per pound):

	I Lots of under 1,000 lbs.	II Lots of 1,000 to 20,000 lbs.	III Lots of 20,000 lbs. or more
1. Plant scrap, segregated:			
Solids:			
All S-type alloys except 2S	8½	9½	10
2S	8	9	9½
High grade alloys	7	8	8½
Low grade alloys (includ. No. 12 and piston alloys)	6½	7½	8
Borings and turnings:			
High-grade alloys (including all S-type)	5½	6½	7
Low grade alloys (includ. No. 12 and piston alloys)	5	6	6½
2. Plant scrap, mixed:			
All solids	6	7	7½
Borings and turnings	4	5	5½

Following are the maximum prices for aluminum scrap (in cents per pound)—Con.

	I Lots of under 1,000 lbs.	II Lots of 1,000 to 20,000 lbs.	III Lots of 20,000 lbs. or more
3. Obsolete scrap:			
Pure cable	8	9	9½
Old sheet and utensils (98% minimum aluminum)	7	8	8½
Old castings and forgings	6½	7	7½
Pistons free of struts	6½	7	7½
Pistons with struts	4½	5	5½
Old alloy sheets	5½	6	6½

4. Wrecked aircraft (prepared):

90% plus aluminum alloy content	7
70–90% aluminum alloy content	6
50–70% aluminum alloy content	4

Per pound of aluminum alloy recovered, irrespective of quantity.

5. Drosses, skimmings, grindings, sweepings, sawings, spatters:

50% plus aluminum	5½
Under 50%	4½

Per pound of aluminum contained, irrespective of quantity, as determined by fire assay or hydrogen evolution.

4. Wrecked aircraft (prepared):

90% plus aluminum alloy content	7
70–90% aluminum alloy content	6
50–70% aluminum alloy content	4

5. Drosses, skimmings, grindings, sweepings, sawings, spatters:

50% plus aluminum	5½
Under 50%	4½

Note 1. Meaning of terms. "Plant scrap" means scrap generated in the course of fabrication or manfacture and includes new material or parts rejected or discarded because defective, damaged in processing, part of surplus or idle inventory, or otherwise unfit for use. The mean plant scrap generated by shearing, clipping, cutting, blanking, or similar process, also defective or rejected wrought aluminum parts, defective or rejected castings, and gates, sprues, risers or similar foundry scrap. Scrap shall not be deemed "segregated", whether in the form of solids or in the form of borings, turnings or other machinings, unless it consists of one alloy only and is so identified and handled as to be accepted for reprocessing into aluminum of the original alloy specifications without the necessity for other than routine examination by the processor. The supplier must deliver to the buyer Segregation Certificate PD-706 showing alloy number and specification, and that scrap meets the specification. "Segregated low grade" scrap includes all alloys containing over 1% iron by weight (including free iron) except alloy PM 754.

"Segregated S-type alloy solids" consist of scrap generated from the wrought or S-type alloys such as 17S or 24S. All segregated alloy solids which are not low-grade or S-type are "high-grade."

Note 2: Iron, oil, moisture, etc. If borings, turnings and similar machinings or other grades of aluminum scrap contain oil, water or other forms of contamination, maximum prices may be paid only on basis of actual weight of aluminum or aluminum alloy contained. If aluminum or aluminum alloy content by weight is less than 85% of weight of material, buyer may only pay delivery charges on that portion of weight of material represented by weight of aluminum or aluminum alloy content.

Note 3—Quantity differentials—The requisite quantities for which premiums are provided in columns II and III, may consist of various grades of aluminum scrap, but other metals may not be included for the purpose of making up such quantities.

In computing the weight necessary to obtain a quantity differential, the actual weight of the material at the point of shipment, as determined by the public carrier, or as certified to and accepted by the public carrier, or as certified by a public weigher, is to be used. If the weight of the material at the point of shipment is not determined by any of the methods herein specified the actual weight of the material at the buyer's receiving point shall be used.

Note 4—Aluminum foil and light gauge aluminum sheet which does not exceed 0.006 of an inch in thickness is not considered within this regulation, but the provisions of the General Maximum Price Schedule shall apply.

Note 5: Wrecked aircraft (prepared): Maximum prices are for actual aluminum alloy content of ingot recovered by the buyer's first melt of the entire shipment. By mutual agreement of buyer and seller, 20% of shipment by weight may be used as representative sample in determining amount of aluminum alloy recovered. Where less than 10,000 pounds are received at one time the buyer may estimate the amount of aluminum alloy which will be recovered and make settlement on the basis of that estimate.

Note 6: Premiums for special preparation. Upon the sale of segregated solid aluminum plant scrap of any of the wrought aluminum or S-type alloys, except 2S and 3S, to the Aluminum Company of America, the Olin Corporation, or the Reynolds Metals Company, the following premiums may be charged, demanded, paid or offered.

	Premium (cents per pound)
Baled or packaged, for briquetting	½
Briquetted, or in large pieces too heavy to briquett	1

The above premiums may also be charged upon sale of segregated solid 17S, 24S, or 52S plant scrap to any other person if, but only if, the sale is made pursuant to a specific authorization or directive from the WPB, removing sale from restrictions of Order M-1-d.

Upon sale of wrecked aircraft, prepared, a premium of ½c per pound may be charged, if such scrap is baled by compression or briquetted.

IRON AND STEEL SCRAP[1]

HAROLD E. CARMONY AND HERBERT L. CULLEN

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GENERAL SUMMARY

Since the beginning of the war in 1939 expanding war-industries needs have been responsible for a continued stimulus in the production of steel ingots and castings; consequently, a new record has been established each year. Despite work stoppages which caused a production loss of 500,000 tons or more, 1943 was no exception, and steel output increased 3 percent over that in 1942; as a consequence, the use of ferrous scrap in steel-making furnaces rose 4 percent above the consumption in 1942, creating a new record. This occurred contrary to expectations that the expanded pig-iron-producing capacity would effect a reduction in the use of ferrous scrap, and it was a direct consequence of the superb effort of the scrap industry to maintain the flow of prepared scrap to consuming mills, despite virtual exhaustion of most of the natural sources of material for preparation. Pig-iron production increased 3 percent over that in 1942, and the use of this material in the manufacture of steel ingots and castings rose 4 percent. During the 12 months of 1943 scrap consumption was fairly stable, since steel-ingot production upon a monthly basis ranged from about 94 to 101 percent of capacity. The consumption of scrap reached a high point in October 1943, being surpassed only by October 1941—the all-time peak in scrap use.

The total consumption of ferrous scrap and pig iron in 1943 increased 2 percent over that in 1942. Charges to steel furnaces totaled 101,268,425 short tons; 19,376,729 tons were melted in iron furnaces, making a total of 120,645,154 tons that were remelted in the manufacture of steel and iron products. In addition, 1,320,961 tons of scrap were used in the production of ferro-alloys and for miscellaneous purposes, such as rerolling and chemical use, producing a new record for total consumption of ferrous scrap and pig iron—121,966,115 tons. In making the average ton of steel in 1943, less scrap and more pig iron were used than in 1942; the relative consumption of purchased scrap declined considerably in 1943 from 1942, whereas consumption of home scrap increased greatly. In iron furnaces, however, the relative use of total scrap increased while that of pig iron declined, owing to the inability of small foundry operators to obtain pig iron under allocation, which compelled them to use more purchased scrap. The imposition of certain limitation orders restricting the manufacture of cast-iron products for civilian purposes caused a general reduction in the use of ferrous scrap and pig iron in cupola furnaces throughout the country. Nevertheless, this diminution of consumption in cupola furnaces was more than offset by the increased use in the steel-making furnaces of the greatly expanded industry. Moreover, air-furnace capacity for the production of malleable iron, having been found to be inadequate to meet requirements, was enlarged by the construction of new plants, thereby assisting in counterbalancing the reduction in use by cupola-furnace operators.

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[1] Minerals Yearbook, 1939, p. 513, gives definitions of the various scrap terms used in this report.

Prices for scrap were unaltered in 1943, remaining at the maximum levels established in 1941 by the Office of Price Administration. The quotation throughout the year for No. 1 Heavy-Melting steel scrap at Pittsburgh was $20 per gross ton ($17.86 a short ton), according to Iron Age, and No. 1 Cast Cupola scrap was quoted at the same level. The price of basic pig iron, established in December 1940 at $23.50 per gross ton ($20.98 a short ton) at Valley furnaces, prevailed throughout 1943.

Exports of ferrous scrap from the United States in 1943 were the lowest in many years, declining 61 percent from those in 1942. Several factors were combined to cause this large reduction—the high demand for and dwindling supplies of scrap, the Federal control of exports, and the need for shipping facilities to transport finished materials in preference to scrap.

Because of the continued high operating rate of the steel industry and the depletion of scrap reserves, dealers and brokers had considerable difficulty in maintaining the flow of much-needed scrap to the consuming mills, with scrap shipments declining steadily during the summer months. After the middle of the year, dealers depended more and more on industrial scrap to fill their orders, since collections from country points became increasingly difficult because of tire and gasoline rationing, and household scrap (usually gathered by peddlers) had practically vanished; also, salvage by automobile wreckers diminished rapidly. The decreased auto-wrecker salvage was due mainly to Conservation Order M-311, which, being designed to prevent the scrapping of serviceable automotive parts, naturally had a deleterious effect on the flow of scrap from automobile graveyards. A partial solution to the supply problem was anticipated by the return of battlefield scrap from overseas; but, contrary to the expectations of industry, which had been promised large tonnages of such material, very little had been received up to the end of the year, mainly because the time required for loading ships in foreign ports would have been too great.

All of the foregoing factors combined to produce a precipitate decline in inventories of purchased scrap, which were reduced over 600,000 tons throughout the year. However, in contrast to 1942, little alarm was expressed regarding the position of domestic stocks of iron and steel scrap. The survey of suppliers', producers', and consumers' stocks at the end of 1943 [2] indicated inventories of 7,175,500 short tons, equivalent to 6 weeks' supply at the average weekly rate of consumption during the year, as compared with stocks of 7,803,151 tons at the beginning of the year. Consumers' stocks of scrap decreased from 6,316,138 tons at the beginning of 1943 to 5,872,251 tons at the close. In contrast with the decline in scrap inventories, pig-iron stocks increased approximately 200,000 tons—from 1,454,665 tons on January 1 to 1,634,701 tons at the year end.

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[2] Bureau of Mines, Iron and Steel Scrap Monthly Reports: No. 40, February 24, 1944, 6 pp.

Salient statistics of ferrous scrap and pig iron in the United States, 1942–43

	1942	1943	Change in 1943 (percent)
Stocks, December 31:			
Ferrous scrap and pig iron at consumers' plants:	*Short tons*	*Short tons*	
Home scrap	1, 605, 756	1, 668, 103	+4
Purchased scrap	4, 710, 382	4, 204, 148	−11
Pig iron	1, 454, 605	1, 634, 701	+12
	7, 770, 803	7, 506, 952	−3
Ferrous scrap at suppliers' yards and producers' plants:			
Prepared scrap	653, 518	641, 142	−2
Unprepared scrap	833, 495	662, 107	−21
	1, 487, 013	1, 303, 249	−12
Consumption:			
Ferrous scrap and pig iron charged to—			
Steel furnaces:[1]			
Home scrap	26, 731, 787	29, 088, 371	+9
Purchased scrap	19, 103, 976	18, 420, 700	−4
Pig iron	51, 762, 946	53, 759, 354	+4
	97, 598, 709	101, 268, 425	+4
Iron furnaces:[2]			
Home scrap	[3] 6, 335, 946	5, 851, 736	−8
Purchased scrap	[3] 6, 827, 702	6, 969, 188	+2
Pig iron	[3] 7, 279, 937	6, 555, 805	−10
	[3] 20, 443, 585	19, 376, 729	−5
Miscellaneous uses[4] and ferro-alloy production:			
Home scrap	61, 639	96, 981	+57
Purchased scrap	1, 204, 101	1, 223, 980	+2
	1, 265, 740	1, 320, 961	+4
All uses:			
Home scrap	33, 129, 372	35, 037, 088	+6
Purchased scrap	27, 135, 779	26, 613, 868	−2
Pig iron	59, 042, 883	60, 315, 159	+2
	119, 308, 034	121, 966, 115	+2
Ferrous scrap (total)	60, 265, 151	61, 650, 956	+2
Exports:			
Iron and steel	136, 540	52, 945	−61
Tin plate, waste-waste, circles, strips, cobbles, etc	5, 196	1, 949	−62
Average prices per gross ton:			
Scrap:			
No. 1 Heavy-Melting, Pittsburgh[5]	$20. 00	$20. 00	0
No. 1 Cast cupola[5]	20. 00	20. 00	0
For export	23. 39	18. 67	−20
Pig iron, f. o. b. Valley furnaces:[5]			
Basic	23. 50	23. 50	0
No. 2 Foundry	24. 00	24. 00	0

[1] Includes open-hearth, bessemer, and electric furnaces.
[2] Includes cupola, air, Brackelsberg, puddling, crucible, and blast furnaces; also direct castings.
[3] Revised figures.
[4] Includes rerolling, reforging, copper precipitation, nonferrous, and chemical uses.
[5] Iron Age.

Figure 1 shows the consumption of purchased scrap and the output of pig iron and steel ingots and castings from 1905 to 1943, inclusive.

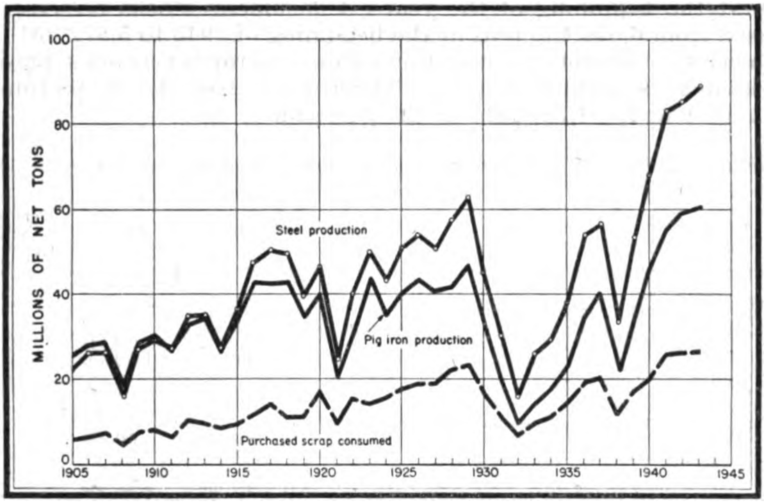

FIGURE 1.—Consumption of purchased scrap and output of pig iron and steel in the United States, 1905–43. Figures on consumption of purchased scrap for 1905–32 are from *State of Minnesota vs. Oliver Iron Mining Co. et al.*, Exhibits, vol. 5, 1935, p. 328; those for 1933–34 are estimates by authors; and those for 1935–43 are based upon Bureau of Mines reports. Data on output of pig iron and steel are as given by the American Iron and Steel Institute.

POST-WAR CONDITIONS

Requirements for iron and steel scrap are expected to decline sharply after the war. It has been estimated that production of steel ingots and castings will decline to 60,000,000 to 65,000,000 tons a year, a drop of nearly one-third from the war peak. The war-expanded pig-iron production capacity of the United States may greatly reduce scrap requirements if the increased ratio of pig-iron to scrap in steel-furnace operations remains unchanged after the war. The lessened requirements of scrap for the production of steel will be offset in part by an increase in scrap requirements for foundries as these plants resume the output of civilian products. Total requirements for iron and steel scrap will probably be greater than before the war. Post-war supplies of scrap, on the other hand, may increase greatly. Despite the great reduction in manufacturers' scrap following war-contract cancellations, the potential supply of purchased scrap may exceed requirements. Much of the scrap available after the war will be held by various Government agencies, either in the form of "in-process" or semifabricated material or as surplus war equipment and battlefield scrap. The orderly disposition of this material will greatly reduce the possibility of unbalance in the scrap industry.

PRICES [3]

Price Schedule 4, issued in 1941, establishing maximum prices for iron and steel scrap, later revised in February 1942 and entitled Revised Price Schedule 4, remained in effect throughout 1943, thereby maintaining scrap prices at a constant level, although steel-ingot production consistently approached 100 percent of rated capacity. Market quotations for both No. 1 Heavy-Melting steel and No. 1 Cast cupola scrap continued unchanged at $20 a gross ton ($17.86 per short ton) Pittsburgh.

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[3] Pittsburgh price quotations from Iron Age.

The Office of Price Administration issued four amendments to revised Price Schedule 4 during 1943 that were designed mainly to assist the dealers financially and encourage the processing of scrap. Some of the changes were of a minor nature, such as the extension of certain basing points and creation of new remote areas. Of major importance to dealers was the change made in January, reducing the price consumers could pay for unprepared scrap; also, the amendment issued on December 13 permitting foundries to pay transportation charges to dealers' yards on cast-iron scrap originating in remote areas or allocated to them.

The price of basic pig iron, established at $23.50 per gross ton ($20.98 per short ton) at Valley furnaces late in December 1940, remained unchanged throughout 1943.

As the price of scrap exported from the United States was regulated by Revised Price Schedule 4, the export price structure remained firm during the entire year. However, export-scrap prices, as indicated by the declared value of iron- and steel-scrap exports, declined in 1943, averaging only $18.67 per gross ton ($16.67 per short ton) or approximately 20 percent lower than the 1942 average of $23.39 ($20.89).

LEGISLATION

No bills or resolutions of any nature regarding iron and steel scrap were introduced into the first session of the Seventy-eighth Congress. However, both the Office of Price Administration and the War Production Board, acting under Executive orders, issued amendments to previously instituted regulations, and introduced additional ones.

On March 24 an amendment to Supplementary Order M–21–a was issued, making it mandatory that each producer of alloy steel (including castings), except stainless and tool steel, should use alloy-steel turnings in specified amounts.

To conserve the supply of automotive parts the War Production Board, on May 20, issued Conservation Order M–311, which prohibited any person from scrapping, selling as scrap, or delivering as scrap certain used automotive parts, except when such part was "no longer serviceable." So that automobile wreckers could comply with this order, the Salvage Division of the War Production Board suspended the previously instituted agreement that required the owners of graveyards to scrap all cars within 60 days after they were acquired.

STOCKS

Available stocks of iron and steel scrap and pig iron in the United States at the end of 1943 were determined by the regular annual canvass of consumers of these materials and the monthly canvass of suppliers and producers. The final results of the annual survey indicate that on December 31, 1943, consumers', suppliers', and producers' stocks of iron and steel scrap totaled 7,175,500 short tons, which represents an 8-percent decline from the 7,803,151 tons on hand December 31, 1942. The largest part of this decline was directly attributable to the consistent decrease in inventories of cast-iron scrap, which diminished more than the total decline in stocks.

CONSUMERS' STOCKS

Consumers' stocks of home and purchased scrap were smaller at the end of 1943 than at the beginning of the year, indicating that despite the increased production of pig iron, iron and steel scrap was still important in establishing the new record for steel production. The supply of 1,668,103 short tons of home scrap on hand December 31 represented a 4-percent increase over the 1,605,756 tons on hand at the beginning of the year, while the supply of 4,204,148 tons of purchased scrap on hand at the end of 1943 was 11 percent smaller than the 4,710.,382 tons on hand at the beginning of the year. Thus, stocks of scrap totaling 5,872,251 tons at the year end were reduced 7 percent from the 6,316,138 tons on hand at the beginning of the year.

In contrast to consumers' stocks of scrap, inventories of pig iron totaling 1,634,701 tons at the year end had increased 12 percent from the 1,454,665 tons on hand at the beginning of the year. This increase in pig-iron stocks was undoubtedly created by the increased production facilities.

SUPPLIERS' AND PRODUCERS' STOCKS

Stocks held by dealers, automobile wreckers, railroads, and manufacturers declined from 1,487,013 short tons on December 31, 1942, to 1,303,249 tons on December 31, 1943. Thus, supplies of iron and steel scrap held by suppliers at the year end were over 12 percent less than those on hand at the beginning of the year. The entire decline in suppliers' stocks may be ascribed to decreases of 19 and 29 percent in inventories held by dealers and automobile wreckers, respectively, whereas railroad stocks were 32 percent larger at the end of 1943 than at the beginning, with supplies held by manufacturers increasing 13 percent during the same period.

Consumers' stocks of ferrous scrap and pig iron on hand in the United States on December 31, 1942, and December 31, 1943, by States and districts, in short tons

State and district	December 31, 1942				December 31, 1943			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Connecticut	5,392	34,199	39,591	14,535	4,360	42,990	47,350	23,330
Maine	143	4,701	4,844	1,444	609	3,833	4,442	1,724
Massachusetts	15,703	84,977	100,680	42,847	19,678	66,974	86,652	65,124
New Hampshire	355	2,788	3,143	643	151	2,171	2,322	563
Rhode Island	1,491	9,556	11,047	5,006	1,272	9,966	11,238	4,065
Vermont	708	9,650	10,358	1,908	757	4,828	5,585	1,447
Total New England	23,792	145,871	169,663	66,383	26,827	130,762	157,589	96,253
Delaware New Jersey	16,772	203,408	220,180	39,049	26,867	122,418	149,285	53,817
New York	44,596	355,376	399,972	90,444	55,854	214,763	270,617	86,724
Pennsylvania	629,311	775,957	1,405,268	392,819	620,478	723,743	1,344,221	391,672
Total Middle Atlantic	690,679	1,334,741	2,025,420	522,312	703,199	1,060,924	1,764,123	532,218
Alabama	64,177	126,645	190,822	71,780	50,089	68,468	118,557	59,988
District of Columbia Kentucky Maryland	34,628	152,604	187,232	28,900	35,927	111,277	147,204	52,107
Florida Georgia	3,300	37,280	40,580	7,400	1,420	39,024	40,444	6,171
Mississippi	26	406	432	97	29	420	449	209
North Carolina	269	8,927	9,196	1,147	263	2,696	2,959	1,591
South Carolina	191	8,161	8,352	888	434	5,397	5,831	1,049
Tennessee Virginia	6,642	105,891	112,533	12,315	9,730	61,706	71,436	18,366
West Virginia	5,764	80,575	86,339	12,356	6,710	83,521	90,231	32,237
Total Southeastern	114,997	520,489	635,486	134,883	104,602	372,509	477,111	171,718
Arkansas Louisiana Oklahoma	787	24,581	25,368	409	1,153	24,245	25,398	970
Texas	4,139	64,339	68,478	1,690	3,871	48,778	52,649	3,114
Total Southwestern	4,926	88,920	93,846	2,099	5,024	73,023	78,047	4,084
Illinois	128,989	522,538	651,527	93,325	131,593	426,382	557,975	154,391
Indiana	183,301	309,529	492,830	79,448	146,425	302,729	449,154	75,243
Iowa	3,534	53,616	57,150	10,342	3,063	31,847	34,910	7,689
Kansas Nebraska	585	14,054	14,639	923	258	11,302	11,560	1,202
Michigan Wisconsin	111,566	304,760	416,326	233,074	152,664	379,165	531,829	199,878
Minnesota	10,047	126,302	136,349	7,384	11,331	40,612	51,943	8,438
Missouri	3,378	95,891	99,269	8,755	8,280	102,214	110,494	17,301
North Dakota South Dakota	2,038	118	2,156	49	1,687	135	1,822	71
Ohio	281,693	634,767	916,460	252,305	315,306	755,985	1,071,291	266,558
Total North Central	725,131	2,061,575	2,786,706	685,605	770,607	2,050,371	2,820,978	730,771
Arizona Nevada New Mexico	2,351	16,600	18,951	116	1,487	30,059	31,546	35
Colorado Utah	16,462	159,650	176,112	14,182	10,053	93,621	103,674	13,653
Idaho	2	3,026	3,028	55	1	2,668	2,669	32
Wyoming	4	1	5	1	4		4	11
Montana	2,735	18,752	21,487	137	3,316	14,564	17,880	153
Total Rocky Mountain	21,554	198,029	219,583	14,491	14,861	140,912	155,773	13,884
Alaska Oregon Washington	5,947	76,230	82,177	3,252	6,923	75,720	82,643	5,606
California	18,730	284,527	303,257	25,640	36,060	299,927	335,987	80,172
Total Pacific Coast	24,677	360,757	385,434	28,892	42,983	375,647	418,630	85,778
Total United States	1,605,756	4,710,382	6,316,138	1,454,665	1,668 103	4,204,148	5,872,251	1,634,701

Suppliers' stocks of iron and steel scrap on hand December 31, 1942, and December 31, 1943, by States and districts, in short tons

State and district	December 31, 1942			December 31, 1943		
	Prepared	Unprepared	Total	Prepared	Unprepared	Total
Connecticut	12,915	11,976	24,891	13,439	5,677	19.116
Maine	5,192	4,178	9,370	4,664	2.883	7,547
Massachusetts	18,449	27,962	46,411	20,760	22,852	43.612
New Hampshire	922	2,437	3,359	1,013	2,657	3.670
Rhode Island	2,286	5,097	7,383	1,969	1,619	3,588
Vermont	3,031	2,620	5,651	2,761	2,463	5,224
Total New England	42,795	54,270	97,065	44,606	38,151	82,757
Delaware	919	1,052	1,971	955	1,124	2.079
New Jersey	19,890	19,660	39,550	21,110	17.091	38,201
New York	47,453	71,830	119,283	39,160	56,938	96.098
Pennsylvania	54,831	87,387	142,218	52,985	66,090	119,075
Total Middle Atlantic	123,093	179,929	303,022	114,210	141.243	255,453
Alabama	9,709	14,171	23,880	7,543	11,998	19,541
District of Columbia	826	1,440	2,266	1,094	1,063	2,157
Florida	5,253	8,171	13,424	6,134	2,326	8,460
Georgia	8,146	12,374	20,520	8,892	12,511	21,403
Kentucky	10,443	11,336	21,779	10,324	6,164	16,488
Maryland	11,275	13,355	24,630	13,782	13,446	27,228
Mississippi	2,573	7,604	10,177	2,092	4,131	6,223
North Carolina	10,942	7,822	18,764	8,957	3,628	12,585
South Carolina	4,396	5,473	9,869	6,385	3,322	9,707
Tennessee	19,824	39,283	59,107	13,306	16,825	30,131
Virginia	10,918	13,236	24,154	7,432	7,947	15,379
West Virginia	6,303	10,013	16,316	6,964	5,979	12,943
Total Southeastern	100,608	144,278	244,886	92,905	89,340	182,245
Arkansas	2,652	7,837	10,489	1,783	6,955	8,738
Louisiana	6,685	12,086	18,771	6,353	8,143	14,496
Oklahoma	9,390	8,726	18,116	4,819	7,936	12,755
Texas	19,922	38,447	58,369	14,559	19,166	33,725
Total Southwestern	38,649	67,096	105,745	27,514	42,200	69,714
Illinois	42,373	52,624	94,997	46,151	47,881	94,032
Indiana	25,958	28,905	54,863	24,157	22,797	46,954
Iowa	11,684	15,978	27,662	9,332	12.033	21,365
Kansas	7,951	13,141	21.092	6,868	13,699	20,567
Michigan	34,070	45,810	79,880	50,192	35,644	85,836
Minnesota	71,750	44.765	116,515	39,394	16,989	56,383
Missouri	10,764	16,494	27,258	9,205	13,227	22,432
Nebraska	4,701	8.403	13,104	3,111	7,985	11,096
North Dakota	396	2,342	2,738	339	5,810	6,149
Ohio	47,496	57,890	105,386	57,463	64,533	121,996
South Dakota	692	3,776	4.468	697	3,352	4.049
Wisconsin	17,473	29,473	46,946	20,526	21,085	41,611
Total North Central	275,308	319,601	594,909	267,435	265,035	532,470
Arizona	787	5,927	6,714	652	5,871	6,523
Colorado	5,969	3,535	9,504	5,985	5,672	11,657
Idaho	616	985	1,601	501	2.435	2,936
Montana	5,808	2,872	8,680	695	3,756	4,451
Nevada	29	298	327	550	1.990	2,540
New Mexico	1,456	1,789	3,245	834	2,274	3,108
Utah	940	5,228	6,168	1,154	3,837	4,991
Wyoming	1,328	2,941	4,269	1,875	1,214	3,089
Total Rocky Mountain	16,933	23,575	40,508	12,246	27,049	39,295
California	37,768	32,427	70,195	59,621	43,733	103,354
Oregon	5,738	3,064	8,802	9,344	7,149	16,493
Washington	12,626	9,255	21,881	13,261	8,207	21,468
Total Pacific Coast	56,132	44,746	100,878	82,226	59,089	141,315
Total United States	653,518	833,495	1,487,013	641,142	662,107	1,303,249

CONSUMPTION

In the canvass of consumers of ferrous scrap and pig iron in 1943, data were again assembled on the scrap used in miscellaneous operations, such as rerolling, reforging, and chemical uses, and for the production of ferro-alloys, in addition to that used in remelting processes. Statistics are compiled to show the consumption of scrap and pig iron by districts and States and by types of furnace. To avoid disclosing details concerning individual plants reporting, it is necessary in some instances to combine figures for some States. All such combinations are made with a view to revealing details of consumption by types of furnace rather than by geographic subdivision.

The importance of scrap in the conservation of resources can be illustrated by the relative quantities of scrap and ore used in the domestic iron and steel industry. The total scrap consumed in 1943 was equivalent to 126 percent of the iron content of all domestic and foreign iron and manganiferous ores used, as such, in blast furnaces, and purchased scrap alone equaled 54 percent of the iron content of the ores; in 1942 the comparable percentages were 114 and 51.

Scrap constitutes by far the greater part of the ferrous raw materials used in iron and steel plants in the New England, Southwestern, and Pacific Coast districts. These regions used only 6 percent of the total scrap consumed in 1943, the use of pig iron being less than 2 percent. The relative proportions of scrap and pig iron used in the United States in 1943 did not change from those in 1942. However, in two districts—the New England (a small pig-iron producing area) and the Middle Atlantic—proportionately more scrap was used in 1943 than in 1942, whereas in the remaining districts (Southeastern, Southwestern, North Central, Rocky Mountain, and Pacific Coast) proportionately less scrap was used. In six of the seven districts there was a definite decline in the proportion of purchased scrap contained in furnace charges, but in the other district (Rocky Mountain) no change occurred.

Open-hearth steel furnaces employ by far the largest quantities of ferrous scrap and pig iron, although in recent years the use of scrap has been steadily declining and the consumption of pig iron increasing. These furnaces consumed 65 percent of the total scrap in 1943 (66 percent in 1942), 73 percent of the home scrap (71 percent in 1942), 55 percent of the purchased scrap (59 percent in 1942), and 78 percent of the pig iron (77 percent in 1942).

In cupola furnaces, the second-largest consumers of scrap, the downward trend in the relative consumption of scrap and pig iron was again apparent. They used 10 percent of the home scrap in 1943 (12 percent in 1942), 17 percent of the purchased scrap (19 percent in 1942), and only 6 percent of the pig iron (8 percent in 1942).

Open-hearth and cupola furnaces together consumed 83 percent of the home scrap, 72 percent of the purchased scrap, and 84 percent of the pig iron in 1943.

Bessemer converters used 10 percent of the pig iron consumed in 1943 but only relatively small quantities of scrap (0.62 percent of the total). The increase in electric-furnace melting capacity during the year is revealed by the fact that this type of equipment consumed over 17 percent more scrap in 1943 than in 1942. Although furnaces of this nature use only a small part of the total scrap consumed, they took 11.2 percent in 1943, which represented a relatively large increase over the 9.8 percent consumed in 1942. Despite the fact that electric furnaces consumed only 11.2 percent of the total scrap used in 1943, they were important consumers of this material because almost 95 percent of the total charge to this type of equipment was home and purchased scrap.

Ferrous scrap and pig iron consumed in the United States and percent of total derived from home scrap, purchased scrap, and pig iron, 1942–43, by districts

District	1942					1943				
	Total used (short tons)	Percent of total used				Total used (short tons)	Percent of total used			
		Scrap			Pig iron		Scrap			Pig iron
		Home	Purchased	Total			Home	Purchased	Total	
New England	1,602,721	30.9	38.4	69.3	30.7	1,418,703	33.0	37.9	70.9	29.1
Middle Atlantic	42,029,787	26.6	20.1	46.7	53.3	43,358,843	28.4	19.0	47.4	52.6
Southeastern	15,006,739	24.4	19.9	44.3	55.7	14,645,127	26.3	17.4	43.7	56.3
Southwestern	461,624	22.0	76.4	98.4	1.6	624,460	22.7	72.8	95.5	4.5
North Central	56,464,226	29.7	22.7	52.4	47.6	57,567,666	30.0	22.0	52.0	48.0
Rocky Mountain	1,637,012	26.7	32.6	59.3	40.7	1,748,390	26.1	32.6	58.7	41.3
Pacific Coast	2,105,925	21.1	66.0	87.1	12.9	2,602,926	20.9	60.5	81.4	18.6
	119,308,034	27.8	22.7	50.5	49.5	121,963,032	28.7	21.8	50.5	49.5

Proportion of home and purchased scrap and pig iron used in furnace charges in the United States, 1942–43, in percent

Type of furnace	1942				1943			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Open-hearth	27.6	18.9	46.5	53.5	29.1	16.9	46.0	54.0
Bessemer	4.0	1.7	5.7	94.3	4.0	1.7	5.7	94.3
Electric	50.5	48.0	98.5	1.5	46.2	48.4	94.6	5.4
Cupola	29.0	37.8	66.8	33.2	30.5	38.5	69.0	31.0
Air [1]	48.8	18.5	67.3	32.7	50.4	19.2	69.6	30.4
Crucible	73.1	20.7	93.8	6.2	51.0	27.9	78.9	21.1
Puddling	4.7	30.8	35.0	65.0	4.0	27.8	31.8	68.2
Blast	53.3	46.7	100.0		39.7	60.3	100.0	

[1] Includes data for 3 Brackelsberg furnaces.

Consumption of ferrous scrap and pig iron in the United States, 1942–43, by type of furnace, in short tons

Type of furnace or equipment	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
1942					
Open-hearth	145	23,445,884	16,114,069	39,559,953	45,538,846
Bessemer	33	260,025	109,887	369,912	6,131,222
Electric	346	3,025,878	2,880,020	5,905,898	92,878
Cupola [1]	2,764	3,936,643	5,117,922	9,054,565	[2] 4,490,532
Air	129	828,178	313,266	1,141,444	555,436
Brackelsberg	3				
Crucible	13	2,610	741	3,351	221
Puddling	8	3,603	23,174	26,777	49,885
Blast	73	1,564,912	1,372,599	2,937,511	-----
Direct castings	80	-----	-----	-----	2,183,913
Ferro-alloy [1]	20	10,813	307,312	318,125	-----
Miscellaneous	137	50,826	896,789	947,615	-----
	[3] 3,701	33,129,372	27,135,779	60,265,151	59,042,883
1943					
Open-hearth	148	25,442,119	14,771,599	40,213,718	47,107,608
Bessemer	37	268,691	112,241	380,932	6,257,927
Electric	382	3,377,561	3,536,860	6,914,421	393,819
Cupola	2,658	3,540,327	4,463,659	8,003,986	[2] 3,602,918
Air	126	890,257	339,171	1,229,428	537,902
Brackelsberg	3				
Crucible	18	1,102	603	1,705	457
Puddling	8	2,272	15,585	17,857	38,231
Blast	81	1,417,778	2,150,170	3,567,948	-----
Direct castings	39	-----	-----	-----	2,376,297
Ferro-alloy	27	26,168	350,351	376,519	-----
Miscellaneous	153	70,813	873,629	944,442	-----
	[3] 3,680	35,037,088	26,613,868	61,650,956	60,315,159

[1] Revised figures.

[2] Includes some pig iron used in making direct castings.

[3] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

CONSUMPTION BY DISTRICTS AND STATES

All 48 States, the District of Columbia, and Alaska contain plants that use ferrous scrap and pig iron, the greatest consumption being concentrated in the steel-making centers of the North Central, Middle Atlantic, and Southeastern districts. These areas include the 8 largest consuming States, which used 82 percent of the total scrap, 91 percent of the pig iron, and 86 percent of the total scrap and pig iron charged into furnaces in 1943; the percentages are unchanged from the comparable figures in 1942. The 8 States (the relative position of which varied only slightly from 1942) and the percentage of the total ferrous scrap and pig iron consumed in each in 1943 were as follows: Pennsylvania 29, Ohio 20, Indiana 11, Illinois 9, New York 5, Michigan 4, Alabama 4, and Maryland 4.

Despite the increased use of ferrous scrap and pig iron there were two districts (New England and Southeastern) in which the consumption of these materials declined, more especially in the New England area. This decrease undoubtedly was caused by the limitation orders imposed upon foundries, since the steel-industry expansion did not materially affect these regions.

Consumption of ferrous scrap and pig iron in the United States, 1939–43, by districts

District and year	Active plants reporting	Scrap						Pig iron	
		Home		Purchased		Total			
		Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)
New England:									
1939	263	240,931	+71.7	385,805	+53.8	626,736	+60.2	239,753	+64.4
1940	270	283,607	+17.7	413,993	+7.3	697,600	+11.3	301,997	+26.0
1941	267	489,163	+72.5	566,952	+36.9	1,056,115	+51.4	476,768	+57.9
1942	271	494,569	+1.1	616,166	+8.7	1,110,735	+5.2	491,986	+3.2
1943	266	467,711	−5.4	538,469	−12.6	1,006,180	−9.4	412,523	−16.2
Middle Atlantic:									
1939	835	5,840,586	+50.4	4,660,910	+57.0	10,501,496	+53.3	12,250,912	+85.1
1940	831	8,197,874	+40.4	5,607,105	+20.3	13,804,979	+31.5	17,400,042	+42.0
1941	859	11,472,727	+39.9	7,796,243	+39.0	19,268,970	+39.6	20,787,804	+19.5
1942	914	11,190,820	−2.5	8,446,963	+8.3	19,637,783	+1.9	22,392,004	+7.7
1943	916	12,292,266	+9.8	8,251,262	−2.3	20,543,528	+4.6	22,815,315	+1.9
Southeastern:									
1939	470	2,593,437	+46.9	2,019,620	+44.9	4,613,057	+46.0	5,853,055	+52.9
1940	473	3,137,588	+21.0	2,485,652	+23.1	5,623,240	+21.9	6,905,435	+18.0
1941	490	3,761,458	+19.9	2,825,903	+13.7	6,587,361	+17.1	7,699,004	+11.5
1942	526	3,669,073	−2.5	2,981,358	+5.5	6,650,431	+1.0	8,356,308	+8.5
1943	512	3,857,196	+5.1	2,540,189	−14.8	6,397,385	−3.8	8,247,742	−1.3
Southwestern:									
1939	131	39,865	+1.2	125,968	+14.1	165,833	+10.7	4,575	−9.0
1940	132	39,674	−.5	135,909	+7.9	175,583	+5.9	4,434	−3.1
1941	139	74,059	+86.7	215,699	+58.7	289,758	+65.0	5,707	+28.7
1942	138	101,683	+37.3	352,460	+63.4	454,143	+56.7	7,481	+31.1
1943	136	141,916	+39.6	454,731	+29.0	596,647	+31.4	27,813	+271.8
North Central:									
1939	1,374	10,365,278	+58.8	8,468,527	+47.0	18,833,805	+53.3	16,291,065	+65.0
1940	1,377	12,801,283	+23.5	9,622,839	+13.6	22,424,122	+19.1	20,926,271	+28.5
1941	1,424	17,227,439	+34.6	12,329,204	+28.1	29,556,643	+31.8	26,358,993	+26.0
1942	1,480	16,793,338	−2.5	12,814,917	+3.9	29,608,255	+.2	26,855,971	+1.9
1943	1,442	17,276,757	+2.9	12,685,489	−1.0	29,962,246	+1.2	27,605,420	+2.8
Rocky Mountain:									
1939	68	224,007	+119.7	280,988	+73.5	504,995	+91.3	412,564	+169.7
1940	66	260,825	+16.4	341,269	+21.5	602,094	+19.2	458,209	+11.1
1941	75	421,191	+61.5	446,745	+30.9	867,936	+44.2	645,038	+40.8
1942	87	436,470	+3.6	533,604	+19.4	970,074	+11.8	666,938	+3.4
1943	91	456,135	+4.5	570,034	+6.8	1,026,169	+5.8	722,221	+8.3
Pacific Coast:									
1939	252	317,792	+42.3	762,822	+31.0	1,080,614	+34.2	180,775	+72.8
1940	258	326,872	+2.9	875,181	+14.7	1,202,053	+11.2	189,440	+4.8
1941	277	458,643	+40.3	1,130,830	+29.2	1,589,473	+32.2	212,158	+12.0
1942	285	443,419	−3.3	1,390,311	+22.9	1,833,730	+15.4	272,195	+28.3
1943	317	545,107	+22.9	1,573,694	+13.2	2,118,801	+15.5	484,125	+77.9
United States:									
1939	[1] 3,393	19,621,896	+54.7	16,704,640	+48.8	36,326,536	+52.0	35,232,699	+70.0
1940	[1] 3,407	25,047,723	+27.7	19,481,948	+16.6	44,529,671	+22.6	46,185,828	+31.1
1941	[1] 3,531	33,904,680	+35.4	25,311,576	+29.9	59,216,256	+33.0	56,185,472	+21.7
1942	[1] 3,701	33,129,372	−2.3	27,135,779	+7.2	60,265,151	+1.8	59,042,883	+5.1
1943	[1] 3,680	35,037,088	+5.8	26,613,868	−1.9	61,650,956	+2.3	60,315,159	+2.2

[1] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

Consumption of ferrous scrap and pig iron in the United States in 1943, by States and districts

State and district	Active plants reporting	Scrap						Pig iron	
		Home		Purchased		Total			
		Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Connecticut	68	135,696	0.4	156,142	0.6	291,838	0.5	113,588	0.2
Maine	21	7,974	(1)	5,161	(1)	13,135	(1)	6,133	(1)
Massachusetts	130	261,023	.8	306,491	1.1	567,514	.9	225,465	.4
New Hampshire	19	6,053	(1)	15,513	.1	21,566	(1)	5,830	(1)
Rhode Island	14	42,826	.1	39,135	.1	81,961	.1	46,756	.1
Vermont	14	14,139	(1)	16,027	.1	30,166	.1	14,751	(1)
Total New England	266	467,711	1.3	538,469	2.0	1,006,180	1.6	412,523	.7
Delaware	10	502,583	1.4	574,761	2.1	1,077,344	1.7	415,936	.7
New Jersey	113								
New York	250	1,683,969	4.8	1,352,635	5.1	3,036,604	4.9	3,032,096	5.0
Pennsylvania	543	10,105,714	28.9	6,323,866	23.8	16,429,580	26.7	19,367,283	32.1
Total Middle Atlantic	916	12,292,266	35.1	8,251,262	31.0	20,543,528	33.3	22,815,315	37.8
Alabama	97	1,380,200	3.9	523,134	2.0	1,903,334	3.1	3,101,043	5.2
District of Columbia	4	1,761,421	5.0	1,029,146	3.8	2,790,567	4.5	3,156,432	5.2
Kentucky	27								
Maryland	34								
Florida	23	60,064	.2	135,734	.5	195,798	.3	88,719	.2
Georgia	62								
Mississippi	13	788	(1)	1,681	(1)	2,469	(1)	576	(1)
North Carolina	58	14,337	.1	14,488	.1	28,825	.1	13,464	(1)
South Carolina	21	3,900	(1)	14,664	.1	18,564	(1)	4,610	(1)
Tennessee	70	172,645	.5	281,033	1.1	453,678	.8	134,878	.2
Virginia	67								
West Virginia	36	463,841	1.3	540,309	2.0	1,004,150	1.6	1,748,020	2.9
Total Southeastern	512	3,857,196	11.0	2,540,189	9.6	6,397,385	10.4	8,247,742	13.7
Arkansas	14	30,118	.1	82,547	.3	112,665	.2	4,098	(1)
Louisiana	27								
Oklahoma	25								
Texas	70	111,798	.3	372,184	1.4	483,982	.8	23,715	(1)
Total Southwestern	136	141,916	.4	454,731	1.7	596,647	1.0	27,813	(1)
Illinois	252	3,354,950	9.6	2,614,341	9.8	5,969,291	9.7	5,266,187	8.7
Indiana	163	4,157,579	11.8	1,933,975	7.3	6,091,554	9.9	7,218,967	12.0
Iowa	60	143,391	.4	268,209	1.0	411,600	.7	68,883	.1
Kansas	32	29,558	.1	84,802	.3	114,360	.2	6,682	(1)
Nebraska	17								
Michigan	212	2,454,873	7.0	1,720,931	6.5	4,175,804	6.8	2,098,447	3.5
Wisconsin	134								
Minnesota	80	246,742	.7	296,980	1.1	543,722	.9	412,853	.7
Missouri	76	231,203	.7	656,688	2.5	887,891	1.4	123,124	.2
North Dakota	2	679	(1)	513	(1)	1,192	(1)	210	(1)
South Dakota	2								
Ohio	412	6,657,782	19.0	5,109,050	19.2	11,766,832	19.0	12,410,067	20.6
Total North Central	1,442	17,276,757	49.3	12,685,489	47.7	29,962,246	48.6	27,605,420	45.8
Arizona	12	13,189	.1	112,132	.4	125,321	.2	81	(1)
Nevada	4								
New Mexico	4								
Colorado	30	429,755	1.2	428,009	1.6	857,764	1.4	721,672	1.2
Utah	23								
Idaho	6	1,704	(1)	6,339	(1)	8,043	(1)	136	(1)
Wyoming	2	1	(1)	13	(1)	14	(1)	5	(1)
Montana	10	11,486	(1)	23,541	.1	35,027	.1	327	(1)
Total Rocky Mountain	91	456,135	1.3	570,034	2.1	1,026,169	1.7	722,221	1.2
Alaska	1	121,830	.4	366,620	1.4	488,450	.8	35,699	.1
Oregon	49								
Washington	76								
California	191	423,277	1.2	1,207,074	4.5	1,630,351	2.6	448,426	.7
Total Pacific Coast	317	545,107	1.6	1,573,694	5.9	2,118,801	3.4	484,125	.8
Total United States:									
1943	[2] 3,680	35,037,088	100.0	26,613,868	100.0	61,650,956	100.0	60,315,159	100.0
1942	[2] 3,701	33,129,372	100.0	27,135,779	100.0	60,265,151	100.0	59,042,883	100.0

[1] Less than 0.05 percent.

[2] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

CONSUMPTION BY TYPE OF FURNACE

Open-hearth furnaces.—Ferrous scrap and pig iron consumed in open hearths in 1943 totaled 87,321,326 tons—an increase of approximately 3 percent over 1942. This increase was made possible by the expansion of steel-making facilities during the year under the direction of the Defense Plant Corporation. Although electric-furnace capacity shared the expansion program, the major part of the tonnage was added to open-hearth capacity. Of the total scrap and pig iron used in open hearths in 1943, home scrap constituted 29 percent, purchased scrap 17 percent, and pig iron 54 percent. The use of purchased scrap decreased 8 percent, whereas the use of home scrap and pig iron increased 9 and 3 percent, respectively.

Charges to open-hearth furnaces in 1943 consisted of 46 percent total scrap and 54 percent pig iron, the proportions being unchanged from 1942. Of the total scrap consumed in open hearths in 1943, 37 percent was purchased scrap compared with 41 percent in 1942 and 40 percent in 1941. Higher proportions of scrap are used in areas remote from pig-iron-producing centers, but the practice of using scrap exclusively is relatively rare. In 1943 only 2 plants out of a total of 148 operated on a 100-percent scrap charge; they consumed only 87,337 tons, merely 0.1 percent of the total consumption of ferrous materials in open hearths.

Pennsylvania, the leading steel-producing State, outranked all others in 1943 in the consumption of ferrous scrap and pig iron in open hearths, followed by Ohio, Indiana, and Illinois.

Consumption of ferrous scrap and pig iron in open-hearth furnaces in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	1	131,744	240,347	372,091	181,759
Massachusetts	2				
Rhode Island	1				
Total: 1943	4	131,744	240,347	372,091	181,759
1942	4	113,600	264,374	377,974	154,343
Middle Atlantic:					
Delaware	1	1,508,821	922,972	2,431,793	2,938,564
New Jersey	3				
New York	8				
Pennsylvania	52	8.050,049	4,237,123	12,287.172	15.406,854
Total: 1943	64	9,558,870	5,160.095	14,718,965	18,345,418
1942	64	8,581.094	5.492,679	14.073,773	17,637,546
Southeastern and Southwestern:					
Alabama	4	1,032,829	559,898	1,592,727	2,653,035
Georgia	1				
Tennessee	1				
Oklahoma	1				
Texas	1				
District of Columbia	1	1,996.336	1,107,114	3,103,450	4,123.015
Kentucky	2				
Maryland	1				
West Virginia	2				
Total: 1943	14	3.029,165	1,667,012	4,696,177	6,776.050
1942	14	2.704.708	1,855.769	4.560,477	6,605.646
North Central:					
Illinois	13	2,276,604	1,387.510	3,664,114	3,688,903
Indiana	8	3,722,214	1,427.018	5,149,232	6,644,162
Michigan	4	956,190	433.573	1,389,763	1,375,381
Iowa	1	160,522	463,487	624,009	63,401
Missouri	3				
Minnesota	1	214,918	148,958	363,876	381,675
Wisconsin	2				
Ohio	25	4.771.838	2,644,566	7,416.404	8.584.902
Total: 1943	57	12.102,286	6,505,112	18,607,398	20,738,424
1942	56	11,498,590	7,437,111	18,935.701	20,324.510

Consumption of ferrous scrap and pig iron in open hearth furnaces in the United States in 1943, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
Rocky Mountain and Pacific Coast:					
Colorado	1	620.054	1.199.033	1,819.087	1,065.957
California	7				
Washington	1				
Total: 1943	9	620.054	1.199,033	1,819,087	1,065.957
1942	7	547,892	1,064.136	1,612,928	816,801
Total United States: 1943	148	25.442.119	14.771.599	40.213.718	47.107.608
1942	145	23,445.884	16.114.069	39,559,953	45,538,846

Bessemer converters.—A total of 6,638,859 tons of ferrous scrap and pig iron was consumed in bessemer converters in 1943—a 2-percent increase over 1942. The proportion of scrap consumed in converter practice is low (amounting to only 5.7 percent in 1943), and the major portion was home scrap. Most of the small tonnage of purchased scrap consumed in converters was used in small steel-foundry plants.

As in the previous 2 years, Pennsylvania was the principal consumer of scrap in bessemer converters in 1943.

Consumption of ferrous scrap and pig iron in bessemer converters in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England and Middle Atlantic:					
Connecticut	1	7,575	5,171	12,746	4,221
Delaware	2				
Massachusetts	1				
New York	1				
Pennsylvania	9	86,902	52,022	138.924	2,268.247
Total: 1943	15	94.477	57,193	151,670	2,272,468
1942	13	102.246	59,693	161,939	2.316,993
Southeastern and Southwestern:					
Alabama	1	33,350	17,533	50,883	624,310
Maryland	1				
Mississippi	1				
West Virginia	1				
Louisiana	1				
Texas	1				
Total: 1943	6	33.350	17,533	50,883	624,310
1942	5	32.015	17,362	49,377	514,930
North Central and Pacific Coast:					
Illinois	3	12,439	17,519	29,958	494,335
Indiana	1	19,959	19,264	39,223	346,291
Iowa	1				
Michigan	2				
Minnesota	1				
Missouri	1	206	630	836	204
California	1				
Washington	1				
Ohio	5	108,260	102	108,362	2,520.319
Total: 1943	16	140,864	37,515	178.379	3,361,149
1942	15	125.764	32.832	158.596	3.299.299
Total United States: 1943	37	268,691	112.241	380,932	6,257,927
1942	33	260,025	109,887	369,912	6,131,222

Electric steel furnaces.—The additional electric-furnace capacity resulting from the steel-industry expansion program was reflected by an increase in consumption of materials. Ferrous scrap and pig iron used in electric furnaces totaled 7,308,240 tons—a 22-percent increase over 1942. Of the 382 active plants reporting, 117 operated exclusively on scrap and consumed 1,051,653 tons—about 14 percent of the total scrap and pig iron used.

In 1943, as in 1942, Ohio led all States in the consumption of scrap in electric furnaces, followed by Pennsylvania, Illinois, Michigan, and California.

Consumption of ferrous scrap and pig iron in electric steel furnaces in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	5	12,890	13,701	26,591	686
New Hampshire	1				
Rhode Island	1				
Massachusetts	12	54,907	21,042	75,949	1,710
Total: 1943	19	67,797	34,743	102,540	2,396
1942	20	49,442	29,780	79,222	2,127
Middle Atlantic:					
Delaware	1	99,850	85,987	185,837	3,123
New Jersey	12				
New York	22	135,847	142,869	278,716	8,934
Pennsylvania	63	863,624	734,586	1,598,210	18,306
Total: 1943	98	1,099,231	963,442	2,062,763	30,363
1942	91	883,298	839,410	1,722,708	20,405
Southeastern:					
District of Columbia	1	44,214	71,073	115,287	717
Kentucky	1				
Maryland	3				
West Virginia	1				
Alabama	6	37,679	46,472	84,151	1,079
Florida	1				
Georgia	3				
Mississippi	1				
North Carolina	1	34,722	42,178	76,900	3,598
Tennessee	5				
Virginia	3				
Total: 1943	26	116,615	159,723	276,338	5.394
1942	24	75,836	146,611	222,447	1,776
Southwestern:					
Arkansas	2	51,810	58,606	110,416	1,215
Oklahoma	2				
Louisiana	4				
Texas	11				
Total: 1943	19	51,810	58,606	110,416	1,215
1942	14	34,550	47,456	82,006	653
North Central:					
Illinois	27	406,436	436,233	842,669	39,413
Indiana	14	75,939	58,674	134,613	1,624
Iowa	5	37,396	34,228	71,624	2,246
Kansas	1				
Nebraska	1				
Michigan	32	342,737	292,136	634,873	23,071
Minnesota	4	7,710	12,559	20,269	443
Missouri	10	18,388	18,045	36,433	1,748
Ohio	38	862,327	999,823	1,862,150	273,148
Wisconsin	13	100,645	126,682	227,327	8,463
Total: 1943	145	1,851,578	1,978,380	3,829,958	350,156
1942	140	1,855,862	1,544,427	3,400,289	66,159
Rocky Mountain:					
Arizona	2	9,820	17,537	27,357	298
Colorado	2				
Nevada	1				
Utah	1				
Total: 1943	6	9,820	17,537	27,357	298
1942	6	11,291	18,113	29,404	314
Pacific Coast:					
Alaska	1	20,343	37,406	57,749	122
Oregon	10				
California	38	118,603	209,578	328,181	3,534
Washington	20	41,674	77,445	119,119	341
Total: 1943	69	180,620	324,429	505,049	3,997
1942	51	115,599	254,223	369,822	1,444
Total United States: 1943	382	3,377,561	3,536,860	6,914,421	393,819
1942	346	3,025,878	2,880,020	5,905,898	92,878

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	53	70, 904	43, 521	114, 425	69, 472
Maine	21	7, 974	5, 161	13, 135	6, 133
Massachusetts	105	90, 991	115, 640	206, 631	88, 308
New Hampshire	15	2, 197	13, 866	16, 063	3, 915
Rhode Island	11	21, 348	13, 381	34, 729	17, 681
Vermont	14	14, 139	16, 027	30, 166	14, 751
Total: 1943	219	207, 553	207, 596	415, 149	200, 260
1942	224	268, 680	279, 910	548, 590	303, 984
Middle Atlantic:					
Delaware	5	4, 239	6, 265	10, 504	4, 252
New Jersey	75	111, 834	162, 896	274, 730	122, 924
New York	178	202, 262	262, 085	464, 347	214, 837
Pennsylvania	313	350, 966	439, 683	790, 649	501, 528
Total: 1943	571	669, 301	870, 929	1, 540, 230	843, 541
1942	599	799, 153	1, 086, 841	1, 885, 994	1, 136, 570
Southeastern:					
Alabama	71	225, 148	170, 230	395, 378	472, 075
District of Columbia	2	43, 312	61, 930	105, 242	28, 010
Maryland	25				
Florida	22	1, 575	4, 499	6, 074	1, 562
Georgia	56	21, 448	36, 046	57, 494	27, 574
Kentucky	22	14, 556	19, 622	34, 178	51, 832
Mississippi	11	687	1, 519	2, 206	576
North Carolina	57	14, 268	14, 488	28, 756	13, 216
South Carolina	20	3, 900	2, 559	6, 459	4, 610
Tennessee	61	85, 848	103, 685	189, 533	89, 340
Virginia	61	48, 762	108, 914	157, 676	40, 941
West Virginia	24	13, 568	27, 843	41, 411	13, 904
Total: 1943	432	473, 072	551, 335	1, 024, 407	743, 640
1942[1]	448	628, 275	756, 034	1, 384, 309	1, 148, 790
Southwestern:					
Arkansas	12	323	1, 071	1, 394	116
Louisiana	21	2, 031	4, 986	7, 017	767
Oklahoma	20	5, 722	13, 282	19, 004	2, 585
Texas	53	24, 736	90, 529	115, 265	8, 232
Total: 1943	106	32, 812	109, 868	142, 680	11, 700
1942	115	37, 948	120, 156	158, 104	4, 565
North Central:					
Illinois	174	403, 874	393, 613	797, 487	324, 863
Indiana	117	192, 600	200, 629	393, 229	174, 136
Iowa	51	78, 949	100, 906	179, 855	54, 604
Kansas	31	19, 312	68, 063	87, 375	4, 128
Michigan	162	562, 266	524, 351	1, 086, 617	412, 354
Minnesota	67	39, 819	121, 509	161, 328	35, 238
Missouri	55	62, 493	153, 737	216, 230	59, 774
Nebraska	15	4, 931	8, 655	13, 586	2, 537
North Dakota	2	679	513	1, 192	210
South Dakota	2				
Ohio	274	385, 905	517, 636	903, 541	450, 585
Wisconsin	105	236, 653	200, 235	436, 888	161, 505
Total: 1943	1, 055	1, 987, 481	2, 289, 847	4, 277, 328	1, 679, 934
1942	1, 104	2, 018, 004	2, 404, 487	4, 422, 491	1, 780, 883
Rocky Mountain:					
Arizona	5	8, 046	22, 495	30, 541	0
Colorado	23	17, 405	70, 165	87, 570	28, 607
Idaho	5	1, 052	3, 135	4, 187	136
Montana	7	9, 553	7, 072	16, 625	327
Nevada	1	997	7, 155	8, 152	32
New Mexico	2				
Wyoming	2	1	13	14	5
Utah	15	26, 413	50, 624	77, 037	14, 951
Total: 1943	60	63, 467	160, 659	224, 126	44, 058
1942	61	70, 679	160, 467	231, 146	58, 480

See footnotes at end of table.

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1943, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
Pacific Coast:					
California	131	81, 646	196, 409	278, 055	58, 271
Oregon	37	11, 205	32, 178	43, 383	13, 580
Washington	47	13, 790	44, 838	58, 628	7, 934
Total: 1943	215	106, 641	273, 425	380, 066	79, 785
1942	212	113, 904	310, 027	423, 931	57, 260
Total United States: 1943	2, 658	3, 540, 327	4, 463, 659	8, 003, 986	[2] 3, 602, 918
1942 [1]	2, 763	3, 936, 643	5, 117, 922	9, 054, 565	[2] 4, 490, 532

[1] Revised figures.

[2] Includes some pig iron used in making direct castings.

Cupola furnaces.—Consumption of ferrous scrap and pig iron in cupola furnaces totaled 11,606,904 tons—a 14-percent decrease from 1942. The use of home scrap declined 10 percent, purchased scrap 13 percent, total scrap 12 percent, and pig iron 20 percent. Again, the proportionate decrease in the use of scrap was less than that of pig iron, a circumstance undoubtedly due to the difference in price of the two materials and the inability of many small foundries to obtain pig iron under allocation.

Charges to cupola furnaces consisted of 31 percent home scrap, 38 percent purchased scrap, and 31 percent pig iron; in 1942 the percentages were 29, 38, and 33, respectively. Many cupola furnaces are operated on a 100-percent scrap charge; 421 plants reported the use of 674,973 tons of ferrous scrap without pig iron in 1943 compared with 509 plants that reported the use of 699,690 tons in 1942. However, the number of plants operating in this manner has been declining in recent years.

The relative position of States that are the principal consumers of scrap in cupola furnaces was altered in 1943 as compared with 1942. Michigan used the largest tonnage, followed in order by Ohio, Illinois, Pennsylvania, New York, and Wisconsin.

Consumption of ferrous scrap and pig iron in air furnaces[1] *in the United States in 1943, by districts and States, in short tons*

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	7	23,600	6,189	29,789	13,043
Massachusetts	3	20,595	8,713	29,308	14,772
New Hampshire	1				
Rhode Island	1				
Total: 1943	12	44,195	14,902	59,907	27,815
1942	13	48,391	14,513	62,904	31,128
Middle Atlantic:					
Delaware	1	13,880	2,820	16.700	11,432
New Jersey	2				
New York	13	64,321	21,857	86,178	33,863
Pennsylvania	25	114,280	43,488	157,768	83,045
Total: 1943	41	192,481	68,165	260,646	128,340
1942	40	182,482	62,643	245,125	131,344
Southeastern and Southwestern:					
West Virginia	2	13,700	8,642	22,342	7,242
Texas	1				
Total: 1943	3	13,700	8,642	22,342	7,242
1942	4	10,857	5,298	16,155	6,022
North Central:					
Illinois	15	236,640	97,484	334,124	143,091
Indiana	10				
Michigan	8	100,848	36,144	136,992	53,260
Iowa	1	13,488	3,772	17,260	11,784
Minnesota	1				
Missouri	1				
Ohio	22	204,841	92,921	297,762	109,789
Wisconsin	11	77,596	16,246	93,842	52,222
Total: 1943	69	633,413	246,567	879,980	370,146
1942	71	581,557	229,794	811,351	382,174
Rocky Mountain and Pacific Coast:					
Colorado	1	6,468	895	7,363	4,359
California	2				
Washington	1				
Total: 1943	4	6,468	895	7,363	4,359
1942	4	4,891	1,018	5,909	4,768
Total United States: 1943	129	890,257	339,171	1,229,428	537,902
1942	132	828,178	313,266	1,141,444	555,436

[1] Includes 3 Brackelsberg furnaces, 1 each in Indiana, Ohio, and Michigan.

Air furnaces.—Ferrous scrap and pig iron consumed in air furnaces in 1943 amounted to 1,767,330 tons—an increase of 4 percent over 1942. Although an increased production of malleable iron was indicated by this gain in ferrous materials used, the total furnace capacity was inadequate, and new malleable iron plants were under construction at the end of the year. As compared with 1942, the use of home scrap in air furnaces increased over 7 percent, purchased scrap 8 percent, and total scrap 8 percent; in contrast, the use of pig iron declined 3 percent.

Since 1940 no air-furnace operators have reported the exclusive use of scrap in charges to this type of equipment. There was no change in the relative position of the States that are the principal consumers of scrap in air furnaces. As in 1942, Ohio led in the use of scrap in air furnaces, followed in order by Illinois, Pennsylvania, Indiana, Michigan, Wisconsin, and New York.

Consumption of ferrous scrap and pig iron in crucible and puddling furnaces in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	1	402	273	675	61
Massachusetts	2				
New Hampshire	1				
Total: 1943	4	402	273	675	61
1942	4	293	265	558	2
Middle Atlantic and Southeastern:					
New Jersey	2	395	3,210	3,605	15,220
New York	1				
Kentucky	1				
Pennsylvania	11	2,457	12,688	15,145	23,220
Total: 1943	15	2,852	15,898	18,750	38,440
1942	14	5,851	23,641	29,492	49,956
North Central:					
Indiana	1	72	15	87	148
Ohio	2				
Wisconsin	1				
Total: 1943	4	72	15	87	148
1942	2	35	9	44	64
Southwestern and Pacific Coast:					
Oklahoma	1	48	2	50	39
California	2				
Total: 1943	3	48	2	50	39
1942	1	34	----------	34	34
Total United States: 1943	26	3,374	16,188	19,562	38,688
1942	21	6,213	23,915	30,128	50,056

Crucible and puddling furnaces.—Crucible and puddling furnaces, whose combined output of steel and iron is very small, consume only minor quantities of ferrous raw materials.

Consumption of ferrous scrap in blast furnaces in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
New England and Middle Atlantic:				
Massachusetts	1	12,163	29,145	41,308
New York	6	33,051	65,312	98,363
Pennsylvania	23	614,809	699,760	1,314,569
Total: 1943	30	660,023	794,217	1,454,240
1942	24	636,666	521,818	1,158,484
Southeastern:				
Alabama	8	171,336	46,229	217,565
Kentucky	1	74,062	168,407	242,469
Maryland	1			
Tennessee	1			
Virginia	1			
West Virginia	2			
Total: 1943	14	245,398	214,636	460,034
1942	14	242,926	185,639	428,565
North Central:				
Illinois	6	111,116	155,458	266,574
Indiana	3	38,031	183,699	221,730
Michigan	3	44,873	64,952	109,825
Minnesota	2			
Ohio	20	311,844	736,357	1,048,201
Total: 1943	34	505,864	1,140,466	1,646,330
1942	33	678,468	664,787	1,343,255
Rocky Mountain and Pacific Coast:				
Colorado	1	6,493	851	7,344
Utah	1			
California	1			
Total: 1943	3	6,493	851	7,344
1942	2	6,852	355	7,207
Total United States: 1943	81	1,417,778	2,150,170	3,567,948
1942	73	1,564,912	1,372,599	2,937,511

Blast furnaces.—Ferrous scrap constitutes only a small proportion of the metal-bearing materials consumed in blast furnaces. Other materials used in 1943 were 96,819,571 tons of iron and manganiferous ores, 12,982,013 tons of sinter (produced from iron ore, flue dust, and other materials), 297,128 tons of pyrite cinder, 3,337,367 tons of mill cinder and roll scale, 3,392,178 tons of open-hearth and bessemer slag, 148,944 tons of raw flue dust, and 190,086 tons of other materials. Total consumption of scrap in 1943, as reported by 81 plants operating blast furnaces for the production of pig iron, was 3,567,948 tons—a 21-percent increase over 1942. Of the 1943 total 40 percent was home scrap and 60 percent purchased scrap; in 1942 the comparable percentages were 53 and 47. This direct reversal in the proportions of home and purchased scrap charged to blast furnaces occurred early in 1943, when a preponderance of lightweight scrap, such as turnings and borings, became available. The abundance of this material was caused by changes in manufacturing processes.

The downward trend in the ratio of scrap used to pig iron produced, manifest in 1942, was reversed in 1943 when it increased to 5.9 percent compared with 5.0 percent in 1942 and 5.3 percent in 1941. Purchased scrap was equivalent to 3.5 percent of the pig iron produced in 1943 compared with 2.3 percent in 1942 and 2.4 percent in 1941.

Consumption of ferrous scrap by ferro-alloy producers in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
Middle Atlantic:				
New York	6	6	86,776	86,782
Pennsylvania	6	4,157	5,855	10,012
Total: 1943	12	4,163	92,631	96,794
1942	8	255	75,733	75,988
North Central:				
Iowa	1	21,988	157,036	179,024
Minnesota	1			
Ohio	5			
Total: 1943	7	21,988	157,036	179,024
1942	6	10,539	133,378	143,917
Southeastern:				
Alabama	1	----------	89,705	89,705
South Carolina	1			
Tennessee	1			
West Virginia	1			
Total: 1943	4	----------	89,705	89,705
1942 [1]	4	----------	92,807	92,807
Pacific Coast:				
California	1	17	10,979	10,996
Oregon	1			
Washington	2			
Total: 1943	4	17	10,979	10,996
1942	2	19	5,394	5,413
Total United States: 1943	27	26,168	350,351	376,519
1942 [1]	20	10,813	307,312	318,125

[1] Revised figures.

USE IN FERRO-ALLOY PRODUCTION

Consumption of iron and steel scrap in the manufacture of ferro-alloys totaled 376,519 tons—an 18-percent increase over the 318,125 tons used in 1942. Charges of scrap in ferro-alloy production consisted of 7 percent home scrap and 93 percent purchased scrap; no pig iron was reported as being consumed. Scrap was used for this purpose in 19 electric-furnace plants, 6 blast-furnace plants, and 2 aluminothermic-reduction-process plants. Of the total scrap used for ferro-alloy manufacture, 88 percent was charged to electric furnaces.

Iowa was the largest consumer of scrap in ferro-alloy production, followed by New York, Alabama, and Ohio.

Consumption of ferrous scrap in miscellaneous uses in the United States in 1943, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
New England:				
Massachusetts	4	2,642	10,247	12,889
New Hampshire	1			
Total: 1943	5	2,642	10,247	12,889
1942	3	112	12,243	12,355
Middle Atlantic:				
New Jersey	19	3,288	96,680	99,968
New York	12	2,398	66,598	68,996
Pennsylvania	27	18,470	98,661	117,131
Total: 1943	58	24,156	261,939	286,095
1942	50	13,826	303,280	317,106
Southeastern:				
Alabama	4	55	19,779	19,834
Georgia	2	1,801	5,723	7,524
Tennessee	1			
Maryland	2	1,092	73,744	74,836
Virginia	2			
West Virginia	1			
Total: 1943	12	2,948	99,246	102,194
1942	13	3,300	94,993	98,293
Southwestern:				
Louisiana	1	239	15,728	15,967
Oklahoma	1			
Texas	3			
Total: 1943	5	239	15,728	15,967
1942	3	307	7,999	8,306
North Central:				
Illinois	10	10,399	167,097	177,496
Indiana	7	20,279	16,392	36,671
Michigan	1	2,026	25,204	27,230
Nebraska	1			
Wisconsin	2			
Minnesota	3	315	631	946
Missouri	6	0	30,022	30,022
Ohio	11	383	91,713	92,096
Total: 1943	41	33,402	331,059	364,461
1942	42	24,609	368,135	392,744
Rocky Mountain:				
Arizona	5	754	76,552	77,306
Nevada	2			
New Mexico	2			
Colorado	2	2,689	23,097	25,786
Idaho	1			
Montana	3			
Utah	5	1,755	30,337	32,092
Total: 1943	20	5,198	129,986	135,184
1942	15	5,484	78,203	83,687
Pacific Coast:				
California	7	424	24,852	25,276
Oregon	1	1,804	572	2,376
Washington	4			
Total: 1943	12	2,228	25,424	27,652
1942	11	3,188	31,936	35,124
Total United States: 1943	153	70,818	873,629	944,442
1942	137	50,826	896,789	947,615

MISCELLANEOUS USES

A substantial quantity of scrap is consumed each year in such miscellaneous uses as rerolling, reforging, flux in lead blast furnaces, and nonferrous-alloy manufacture and as a reducing agent in chemical processes. A total of 944,442 tons of ferrous scrap was used in these operations in 1943, representing only a slight decline from the 947,615 tons consumed in 1942. As with ferro-alloy production, the major part of the scrap consumed in miscellaneous operations was purchased scrap (93 percent). However, the use of home scrap increased 39 percent over that in 1942, while the use of purchased scrap declined 3 percent. The leading State in the use of scrap in miscellaneous operations was Illinois, followed in order by Pennsylvania, New Jersey, and Ohio.

FOREIGN TRADE [4]

Imports.—Imports of iron and steel scrap into the United States have never been exceptionally large, but because of augmented war demands they increased considerably in 1943, with the result that the usual trend was reversed, and imports were greater than exports. In 1943 such material imported totaled 145,252 short tons valued at $2,425,048 compared with 98,877 tons valued at $1,306,947 in 1942, an increase of 46 percent in tonnage. Of the 1943 total, 106,682 tons came from Canada, 16,991 tons from Cuba, 6,938 tons from the Panama Canal Zone, and the remainder from numerous other countries. In addition, 21,942 tons of tin-plate scrap were imported in 1943, largely from Canada, compared with 26,972 tons in 1942 and 25,312 tons in 1941.

Exports.—Ferrous scrap exports (all types) from the United States were the lowest in many years in 1943, being only 39 percent as large in tonnage and 32 percent as large in value as in 1942. However, this comparison does not fully indicate the tremendous decrease in exports since the beginning of the war. The decline can best be illustrated by comparing exports in 1943 with the average—3,298,326 tons per year—for the 5-year period (1935–39, inclusive) immediately preceding the war. A total of only 54,894 short tons valued at $1,070,809 was exported in 1943 compared with 141,736 tons valued at $3,321,523 in 1942. This indicates that exports in 1943 were less than 2 percent as large in volume as the pre-war average. The extremely low exportation of scrap in 1943 was caused by several factors, including the continuance of export licensing established in 1941 and the enduring high demand for scrap in the United States. The shipments in 1943 included 1,949 tons of tin-plate scrap, waste-waste tin plate, tin-plate circles, cobbles, and similar material, as well as terne-plate clippings, all valued at $188,460. In 1942 exports of this type of scrap totaled 5,196 tons valued at $469,458. The following table shows the principal countries to which scrap was exported during the 5-year period 1939–43.

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[4] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Ferrous scrap exported from the United States, 1939–43, by countries, in short tons

Country	1939	1940	1941	1942	1943
Canada	196,556	411,571	314,565	121,471	34,085
Germany	18,574				
Italy	477,004	356,859			
Japan	2,279,315	1,079,141	324		
Mexico	41,608	42,095	30,119	15,502	18,157
Netherlands	60,665	389			
Poland and Danzig	173,161				
United Kingdom	569,288	1,100,774	539,650	142	115
Other countries	198,401	168,454	19,601	4,621	2,537
	4,014,572	3,159,283	904,249	141,736	54,894
Total value	$55,911,516	$48,314,146	$15,973,863	$3,321,523	$1,070,809

WORLD ASPECTS

Statistics on the production of steel and pig iron, and consequently on the use of iron and steel scrap, during 1943 are not available, as publication of information has been suspended in many of the countries involved.

REVIEW BY COUNTRIES

Canada.[5]—Steel ingot and casting production in Canada in 1943 did not equal the record of 3,121,000 short tons established in 1942, declining 4 percent to 2,997,000 tons. In the production of steel, 1,515,000 tons of pig iron and 1,804,000 tons of iron and steel scrap were used, resulting in a ratio of 46 percent pig iron to 54 percent scrap, which indicates a change in melting practice from 1942, when the proportions were 47 percent pig iron and 53 percent scrap. This change was brought about entirely by the use of more home or revert scrap, since the scrap charge contained 55 percent home scrap and 45 percent purchased scrap, whereas in 1942 the proportion of home scrap in the total scrap charge was only 49 percent, with purchased scrap representing 51 percent.

Pig-iron production in 1943 did not reach the high level attained in 1942, declining more than did the manufacture of steel; it totaled only 1,758,000 tons compared with the record of 1,975,000 tons in 1942, a decrease of 11 percent. Slightly more than 111,000 tons of scrap were used in the manufacture of pig iron in 1943.

At various times during the year fears were expressed that a shortage of scrap might develop, as mills were forced to draw heavily on their surplus stocks to meet requirements, when outside sources of supply could not maintain adequate shipments.[6] Notwithstanding the apprehension felt by some regarding the critical scrap supply, the majority of mills were confident that the increased pig-iron capacity would suffice to replace scrap. Inasmuch as the Canadian Government was alarmed, in the early part of 1943, concerning a probable serious shortage of scrap, action was taken to begin nation-wide salvage campaigns earlier than in previous years, with the anticipation that the salvage record established in 1942 would be improved.[7] Despite these efforts collections fell far below expectations both from the rural districts as well as from mining areas;[8] and in addition, comparatively little scrap was received from automobile wrecking yards. This decline in collections of scrap and the relatively high demand for it created a problem toward the end of the year, since stocks in the yards of dealers were very low; and although mills had established fair stockpiles, inventories of scrap were only approximately half as large as on January 1.[9]

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[5] Figures on steel and pig-iron production and the use of scrap compiled by the Department of Trade and Commerce, Dominion Bureau of Statistics, Ottawa, Canada.

[6] American Metal Market, vol. 50, No. 132, July 13, 1943, p. 7.

[7] Daily Metal Trade, vol. 33, No. 44, March 5, 1943, p. 14.

[8] American Metal Market, vol. 50, No. 229, December 2, 1943, p. 7.

On March 5, 1943, the Steel Controller issued Order SC 25, which provided for the federal licensing of certain dealers; on March 6 Order SC 27 was issued, establishing maximum prices for cast-iron scrap in Ontario and Quebec and for steel scrap in Ontario, Quebec, and the Maritime Provinces.[10] During May, in order to induce larger importation of scrap, the Finance Minister announced the removal of the 10-percent war-exchange tax previously imposed on imports of cast-iron scrap to be remelted for use by Canadian industries.[11]

United Kingdom.—Scrap continued to be a significant factor in the manufacture of iron and steel in the United Kingdom in 1943, especially since the record-making production of the previous year was maintained. The lack of imports was counteracted by a licensing system [12] previously instituted, whereby steel works were assured of receiving fairly regular deliveries of scrap derived from salvage drives, which had succeeded in increasing collections to over 100,000 tons a week.[13] By means of this licensing system deliveries of scrap were maintained at a level that supported capacity steel production,[14] however, less heavy scrap was being shipped than previously, which indicated the need for reliance on lighter grades.

The scrap industry was confronted with a shortage of labor suitable for the preparation of scrap, in addition to the problem of the disposition of steel turnings. Notwithstanding labor shortages and discontinuation of imports, the success of the drive for mobilization of the nation's scrap resources was reflected in the substantial stock piles of iron and steel scrap that were accumulated.[15] Under the scrap-salvaging plan scrap piles were maintained in strategic places as long as possible to serve as constant reminders to the public that the drive is a continuous one and that they were reservoirs to be used by industry. To augment these stock piles it was proposed, in the latter part of 1943, to strip 250,000 old automobiles of reusable parts and then break them up for ultimate use in war weapons; from these cars the automobile wreckers anticipated the salvage of a substantial tonnage of iron and steel scrap.[16] The program for compulsory collection and segregation of domestic scrap by local authorities was ordered to be relaxed after December 31, 1943, so that only those equipped to process the material into a state suitable for ready utilization would be included. This step was taken because large amounts of household scrap had been amassed, such as tin cans and discarded household utensils—a type of material that is bulky and expensive to treat and transport.[17] Thus, it is readily discernible that the scrap position was more favorable than it had been since the early days of the war, and as the drives for iron and steel scrap had been so successful any fears of a shortage of supplies were dispelled, at least for the present.

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[9] American Metal Market, vol. 50, No. 186, September 28, 1943, p. 9.
[10] Canadian Secondary Materials Association, vol. 3, No. 9, October 1, 1943, p. 1.
[11] American Metal Market, vol. 50, No. 93, May 15, 1943, p. 7.
[12] Mining Journal, London, vol. 220, No. 5615, April 3, 1943, p. 169.
[13] Mining Journal, London, vol. 220, No. 5617, April 17, 1943, p. 194.
[14] Steel, vol. 112, No. 18, May 3, 1943, p. 164.
[15] Mining Journal, London, vol. 221, No. 5653, December 25, 1943, p. 642.
[16] Waste Trade Journal, vol. 76, No. 3, October 23, 1943, p. 18.

To segregate essential alloy-steel scrap more effectively, the Controller of Iron and Steel devised a color scheme to be used by producers and dealers for identifying various types of alloys. This was done because large amounts of valuable alloys were lost each week in steel mills on account of poor segregation at the producing source.[18] Then in July the Controller issued a new order to all alloy-steel ingot makers to standardize compositions, the primary purpose being to conserve the use of alloys; they were also directed to use more alloy-steel scrap to reduce the consumption of virgin metals.[19]

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[17] Colliery Guardian, vol. 167, No. 4327, December 3, 1943, pp. 686, 687.
[18] Colliery Guardian, vol. 166, No. 4288, March 5, 1943, p. 283.
[19] Mining Journal, London, vol. 221, No. 5629, July 10, 1943, p. 340.

IRON ORE

By Norwood B. Melcher and Edward J. Langey[1]

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GENERAL FEATURES IN 1943

The domestic iron-ore industry in 1943 was featured by record demand, but shipments were hampered by an unusually late opening (April 28) of the Great Lakes shipping season, unfavorable shipping weather during the season, and several Lake shipping accidents; in consequence total production and shipments decreased 4 and 6 percent, respectively. However, estimated requirements declined during the year as a result of some tapering off of pig-iron demands and certain delays in completing blast-furnace capacities, and at the end of 1943 consumers and lower Lake stocks were adequate in both quantity and distribution to meet the 1944 season comfortably. At the beginning of the Lake shipping season the War Production Board had announced a goal of 95,000,000 gross tons[2] to be shipped down the Lakes, in addition to 2,000,000 tons all-rail. This quantity was based upon estimated requirements of existing blast furnaces and new capacity to be added during 1943. With the difficulties encountered in moving ore on the Lakes during the year, the required goal was gradually reduced to 86,500,000 tons.

Added to the troubles of the iron-mining industry in 1943 was a severe manpower shortage, especially in the northeastern district where it held production down virtually to the pre-war level.

The new MacArthur lock at Sault Ste. Marie was completed and opened to commerce on July 11, 1943. This lock is the largest of the five now completed and is 879 feet long, 81 feet wide, and 31 feet deep. The new emergency loading dock at Escanaba, Mich., which was started in 1942 was abandoned in 1943 after the timber construction was completed but before any steel work had been started. It would be relatively easy to install tracks and put the dock into operation should this added capacity become necessary.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] The iron-ore industry has expressed a preference for the gross-ton unit (2,240 lb.), which will be used in this chapter. However, the chapter Pig Iron, Ferro-Alloys, and Steel in 1943 will continue to present data in net tons (2,000 lb.), the preferred unit in those industries.

Salient statistics of iron ore in the United States, 1942–43

	1942		1943	
	Gross tons	Value	Gross tons	Value
Crude iron ore:				
Production by districts:				
Lake Superior	103, 369, 279	(1)	95, 586, 789	(1)
Southeastern	15, 296, 799		14, 051, 854	
Northeastern	6, 197, 055		7, 018, 617	
Western	1, 664, 026		3, 017, 720	
	126, 527, 159	(1)	119, 674, 980	(1)
Production by mining methods:				
Open pit	92, 894, 166	(1)	86, 849, 778	(1)
Underground	33, 632, 993		32, 825, 202	
	126, 527, 159	(1)	119, 674, 980	(1)
Production by types of ore:				
Hematite	112, 187, 808	(1)	104, 436, 944	(1)
Brown ore	7, 720, 349		7, 126, 582	
Magnetite	6, 617, 979		8, 110, 837	
Carbonate	1, 023		617	
	126, 527, 159	(1)	119, 674, 980	(1)
Shipments	126, 794, 970	(1)	118, 622, 412	(1)
Iron ore: [2]				
Production by districts:				
Lake Superior	91, 005, 021	(1)	85, 789, 017	(1)
Southeastern	9, 159, 228		8, 478, 736	
Northeastern	3, 119, 506		3, 467, 575	
Western	1, 599, 429		2, 859, 994	
Undistributed (byproduct ore)	643, 011		652, 513	
	105, 526, 195	(1)	101. 247, 835	(1)
Production by types of product:				
Direct	81, 742, 150	(1)	79, 833, 785	(1)
Concentrates	20, 078, 625		17, 622, 674	
Sinter	3, 062, 409		3, 138, 863	
Byproduct material (pyrite cinder and sinter)	643, 011		652, 513	
	105, 526, 195	(1)	101, 247, 835	(1)
Production by types of ore:				
Hematite	99, 704, 591	(1)	94, 418, 034	(1)
Brown ore	1, 637, 140		1, 627, 490	
Magnetite	3, 541, 003		4, 549, 181	
Carbonate	450		617	
Byproduct material (pyrite cinder and sinter)	643, 011		652, 513	
	105, 526, 195	(1)	101, 247, 835	(1)
Shipments	105, 988, 514	$279, 178, 751. 00	99, 462, 850	$269, 016, 546. 00
Average value per ton at mine		2. 63		2. 70
Stocks at mines December 31	3, 666, 847	(1)	5, 169, 525	(1)
Imports	731, 352	2, 142, 569. 00	399, 117	1, 827, 033. 00
Exports	2, 515, 388	8, 114, 586. 00	2, 424, 801	8, 117, 156. 00
Consumption	(1)	(1)	100, 456, 989	(1)
Manganiferous ore: [3]				
Shipments	1, 579, 801	4, 866, 602. 00	1, 538, 275	4, 522, 052. 00

[1] Data not available.
[2] Ore containing less than 5 percent manganese.
[3] Ore containing 5 to 35 percent manganese.

Price regulations.—The quoted price of Lake Superior iron ore did not change during 1943. However, on December 15, a regulation was issued by the Office of Price Administration which permitted concerns to sell iron ore at the ceiling price of $4.45 per gross ton at lower Lake ports for Mesabi non-Bessemer ore. As iron ore is normally sold below the quoted price, the actual selling price had averaged around $4.30 since the shipping season of 1941. In effect, the use of the escalator clause permitting changes in iron-ore prices during the year in keeping with costs variations had been resumed. The increase was necessitated by rising production costs—particularly higher labor expenses—and applied to all ore shipped down the Lakes during 1943, on which accounts are settled at the season's closing.

A temporary 8-percent increase in Lake transportation rates was authorized by Office of Price Administration for the period August 31 to December 31. The rates had previously been frozen by the General Maximum Price Regulation of March 1942.

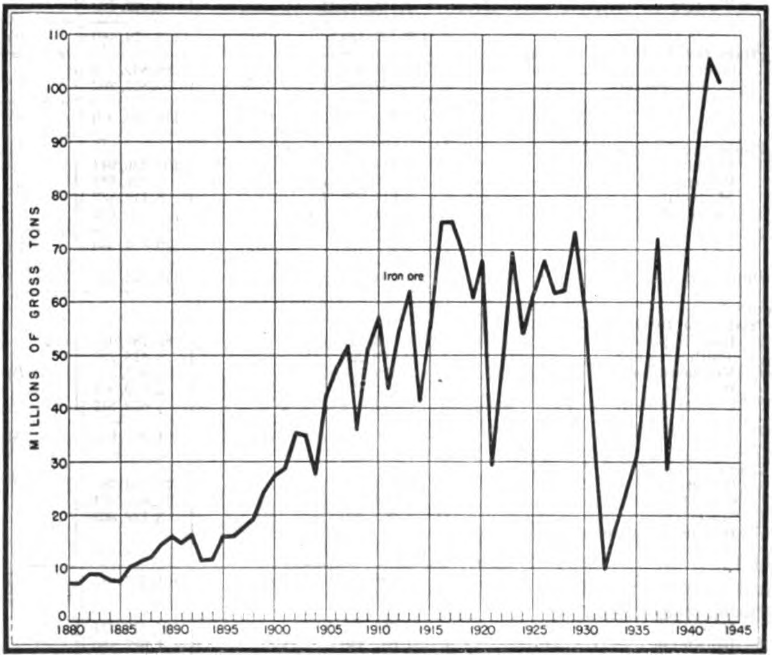

FIGURE 1.—Trends in production of iron ore in the United States, 1880–1943.

POST-WAR OUTLOOK

Iron-ore production in the post-war years will be considerably above pre-war levels but substantially below current rates. As usual, output will be geared to post-war steel activity, on which opinions vary sharply. Pent-up demands for civilian consumer goods, reconversion, and new construction justify the assumption that there will be a brisk demand for steel for several years following the war. That this demand will require continuation of the wartime rate of steel production of nearly 80,000,000 gross tons (90,000,000 net tons) a year seems unlikely. On the other hand, return to the pre-war average of approximately 46,500,000 tons is likewise not indicated. A 54,000,000-gross ton (60,000,000 net tons) steel rate, which seems reasonable, would require 70,000,000 gross tons of iron ore a year compared with 46,318,239 tons in the 5-year period 1935–39 and 73,027,720 tons in 1929.

No significant changes in sources of iron ore are anticipated. The Lake Superior and Birmingham districts will continue to supply most of the ore required for the production of pig iron, although the

Northeastern States and possibly the Western States will supply a somewhat larger proportion than heretofore. Foreign trade in iron ore will continue small in comparison with the domestic trade. Imports from South America and Cuba will be resumed and those from Canada probably increased.

Research on the beneficiation of low-grade ores, which has been under way for a number of years, was expanded in 1943. Additional emphasis on this problem may be expected after the war, not only to provide new sources to replace the high-grade deposits now being rapidly depleted but also to assure ample supplies of iron ore for future emergencies.

During the past few years the unprecedented demand for ore was met largely by stepping up production in the large open-pit mines, where increases in output can be realized much more rapidly and with less manpower than in underground mines. As these open-pit mines will soon be exhausted some alternate means for meeting emergency requirements must be devised.

Several proposals have been made to achieve this objective. It has been suggested that open-pit production should be restricted and the deposits held in reserve for emergency use. Another proposal calls for no interruption to open-pit mining and provision for large stock piles of ore for future peak needs. Stock-pile acquisitions through Government purchase of submarginal ores have been suggested as a means of developing new sources and conserving marginal ores in active mines that might otherwise be lost permanently. Although decisions on national policy regarding this important subject have not yet been arrived at, it is evident that the lower-grade iron-ore resources of the United States will receive increasing attention in the post-war years.

Conservation of high-grade deposits and concomitant development of low-grade iron ores are discouraged by the present tax policies of some States. Proponents of the plan point out that the burden of taxes on unmined reserves must be lifted or greatly reduced so that operating companies may be financially able to defer large-scale mining of these ores. A step in this direction was taken by the Minnesota legislature in 1943, when it reduced the ad valorem tax on taconite reserves.

PRODUCTION AND SHIPMENTS

United States iron-ore mines produced crude ore totaling 119,674,980 gross tons and shipped 118,622,412 tons in 1943—decreases of 5 and 6 percent from 1942. Of the 1943 shipments 34 percent was sent to beneficiation plants, and 66 percent went direct to consumers, compared with 35 percent and 65 percent in 1942. From the crude ore shipped to beneficiation plants, 17,622,674 tons of concentrate and 3,138,863 tons of sinter were produced. In addition, 652,513 tons of byproduct cinder and sinter were produced from the pyrite industry. In all, 100,595,322 gross tons of usable iron ore were produced at mines and mills in 1943. Output came from 287 mines, of which 25 mined over 1,000,000 tons of crude ore each. Minnesota with 69,084,907 tons supplied 69 percent of the usable ore, and Michigan with 15,425,788 tons or 15 percent was the second-largest producer. These two States and Wisconsin with 1,498,749 tons or 1 percent constitute the Lake Superior region (disregarding a small

Crude iron ore mined in the United States, 1942-43, by States and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1942					1943				
	Number of mines	Hematite	Brown ore	Magnetite	Total	Number of mines	Hematite	Brown ore	Magnetite	Total
Alabama	[1] 47	7,748,522	6,188,186		13,936,708	[1] 52	7,339,703	4,901,442		12,241,145
Arizona	1	345			345	2	261			261
Arkansas	0					1			144	144
California	5	[2] 81,719		[2] 13,388	95,107	4	683,751		110,689	794,440
Colorado	0					1		200		200
Georgia	[1] 20	4,579	1,340,300		1,344,879	[1] 23	2,430	1,798,810		1,801,240
Michigan	44	15,624,161			15,624,161	46	15,425,788			15,425,788
Minnesota	101	86,242,531	91,032		86,333,563	114	78,662,252	367,378		79,029,630
Missouri	[1] 4	6,192	54,619		60,811	[1] 6	5,094	47,605		52,699
Nevada	0					6	942		6,426	7,368
New Jersey	4			1,334,690	1,334,690	4			1,263,537	1,263,537
New Mexico	[1] 8	16,635		79,174	95,809	[1] 8			41,744	41,744
New York	5	1,949		4,859,393	[3] 4,862,365	6			5,754,463	[4] 5,756,080
Pennsylvania	2					2				
South Dakota	0					1		[5] 1,678		[5] 1,678
Texas	1		46,212		46,212	1	1,200			1,200
Virginia	2					1		9,469		9,469
Utah	2			321,034	321,034	3			922,959	922,959
Washington	3	1,561		10,300	11,861	3	2,571		10,875	13,446
Wisconsin	2	1,502,587			1,502,587	2	1,498,749			1,498,749
Wyoming	1	957,027			957,027	1	814,203			814,203
Total	[1] 252	[2] 112,187,808	7,720,349	[2] 6,617,979	[3] 126,527,159	[1] 287	104,436,944	[5] 7,126,582	8,110,837	[4][5] 119,674,980

[1] Excludes an undetermined number of small pits. Output of these pits included in tonnage given.
[2] Small quantity of magnetite included with hematite.
[3] Includes 1,023 tons of carbonate ore.
[4] Includes 617 tons of carbonate ore.
[5] Includes 1,098 tons produced in 1942.

quantity produced in southern Minnesota), which supplied 85 percent of the domestic output. About three-fourths of the iron ore mined in 1943 came from open-pit mines.

Shipments of usable ore from mines totaled 98,817,470 gross tons in 1943. Of this quantity, 78,422,615 tons (79 percent) was direct shipping ore for all uses. Total shipments also include 7,363 tons for cement manufacture, 26,164 tons for paint, and 150,051 tons for miscellaneous uses. Shipments of byproduct ore for iron and steel use totaled 645,380 tons in 1943 valued at $3,237,613.

Crude iron ore mined in the United States, 1942–43, by States and mining methods, in gross tons

State	1942			1943		
	Open pit	Underground	Total	Open pit	Underground	Total
Alabama	6, 290, 020	7, 646, 688	13, 936, 708	5, 031, 801	7, 209, 344	12, 241, 145
Arizona	345	....	345	261	....	261
Arkansas	....	....	....	144	....	144
California	94, 172	935	95, 107	794, 440	....	794, 440
Colorado	....	....	....	200	....	200
Georgia	1, 344, 879	....	1, 344, 879	1, 801, 240	....	1, 801, 240
Michigan	[1] 1, 672, 606	[1] 13, 951, 555	15, 624, 161	2, 480, 716	12, 945, 072	15, 425, 788
Minnesota	81, 441, 129	4, 892, 434	86, 333, 563	73, 314, 384	5, 715, 246	79, 029, 630
Missouri	56, 757	4, 054	60, 811	48, 964	3, 735	52, 699
Nevada	....	....	....	7, 368	....	7, 368
New Jersey	....	1, 331, 690	1, 334, 690	....	1, 263, 537	1, 263, 537
New Mexico	93, 645	2, 164	95, 809	41, 744	....	41, 744
New York	1, 523, 067	3, 339, 298	4, 862, 365	2, 383, 535	3, 371, 545	5, 755, 080
Pennsylvania						
South Dakota	....	....	....	1, 678	....	1, 678
Texas	46, 212	....	46, 212	....	1, 200	1, 200
Virginia				9, 469	....	9, 469
Utah	321, 034	....	321, 034	922, 959	....	922, 959
Washington	10, 300	1, 561	11, 861	10, 875	2, 571	13, 446
Wisconsin	....	1, 502, 587	1, 502, 587	....	1, 498, 749	1, 498, 749
Wyoming	....	957, 027	957, 027	....	814, 203	814, 203
	[1] 92, 894, 166	[1] 33, 632, 993	126, 527, 159	86, 849, 778	32, 825, 202	119, 674, 980

[1] Revised.

Crude iron ore shipped from mines in the United States, 1942–43, by States and disposition, in gross tons

State	1942			1943		
	Direct to consumers	To beneficiation plants	Total	Direct to consumers	To beneficiation plants	Totai
Alabama	6, 348, 048	7, 594, 127	13, 942, 175	5, 928, 562	6, 314, 190	12, 242, 752
Arizona	345	....	345	261	....	261
Arkansas	....	....	....	144	....	144
California	92, 875	....	92, 875	725, 225	15, 800	741, 625
Colorado	....	....	....	....	200	200
Georgia	4, 429	1, 340, 300	1, 344, 729	2, 421	1, 798, 810	1, 801, 231
Michigan	16, 129, 474	....	16, 129, 474	14, 510, 357	....	14, 510, 357
Minnesota	56, 417, 526	29, 591, 236	86, 008, 762	53, 687, 887	25, 363, 846	79, 051, 733
Missouri	49, 126	12, 526	61, 652	52, 893	....	52, 893
Nevada	....	....	....	7, 368	....	7, 368
New Jersey	95, 675	1, 247, 701	1, 343, 376	166, 685	1, 106, 098	1, 272, 783
New Mexico	95, 809	....	95, 809	41, 744	....	41, 744
New York	138, 170	4, 754, 385	4, 892, 555	159, 296	5, 589, 485	5, 748, 781
Pennsylvania						
South Dakota	....	....	....	1, 678	....	1, 678
Texas	226	45, 986	46, 212	6, 424	11, 368	17, 792
Virginia						
Utah	319, 834	....	319, 834	911, 839	....	911, 839
Washington	11, 851	....	11, 851	13, 455	....	13, 455
Wisconsin	1, 548, 294	....	1, 548, 294	1, 392, 173	....	1, 392, 173
Wyoming	957, 027	....	957, 027	814, 203	....	814, 203
	82, 208, 709	44, 586, 261	126, 794, 970	78, 422, 615	40, 199, 797	118, 622, 412

Iron ore mined in the United States, 1942–43, by mining districts and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

Variety of ore	Lake Superior district	Birmingham	Chattanooga	Adirondack and Cornwall	New Jersey and S. E. New York	Other	Total
1942							
Crude ore:							
Hematite	103, 369, 279	7, 748, 449	4, 652			1, 065, 428	112, 187, 808
Brown ore		2, 380, 290	2, 300, 865			3, 039, 194	7, 720, 349
Magnetite				4, 859, 393	1, 334, 690	423, 896	6, 617, 979
Carbonate						1, 023	1, 023
	103, 369, 279	10, 128, 739	2, 305, 517	4, 859, 393	1, 334, 690	4, 529, 541	126, 527, 159
Iron ore:							
Hematite	91, 005, 021	7, 629, 490	4, 652			1, 065, 428	99, 704, 591
Brown ore		476, 219	467, 921			693, 000	1, 637, 140
Magnetite				2, 513, 056	604, 051	423, 896	3, 541, 003
Carbonate						450	450
	91, 005, 021	8, 105, 709	472, 573	2, 513, 056	604, 051	2, 182, 774	104, 883, 184
1943							
Crude ore:							
Hematite	95, 586, 789	7, 339, 703	2, 430			1, 508, 022	104, 436, 944
Brown ore		1, 762, 200	2, 503, 034			2, 861, 348	7, 126, 582
Magnetite				5, 754, 463	1, 263, 537	1, 092, 837	8, 110, 837
Carbonate						617	617
	95, 586, 789	9, 101, 903	2, 505, 464	5, 754, 463	1, 263, 537	5, 462, 824	119, 674, 980
Iron ore:							
Hematite	85, 789, 017	7, 118, 565	2, 430			1, 508, 022	94, 418, 034
Brown ore		350, 875	536, 249			740, 366	1, 627, 490
Magnetite				2, 946, 267	520, 691	1, 082, 223	4, 549, 181
Carbonate						617	617
	85, 789, 017	7, 469, 440	538, 679	2, 946, 267	520, 691	3, 331, 228	100, 595, 322

Iron ore produced in the United States, 1942–43, by States and types of product, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1942					1943				
	Direct shipping ore	Sinter [1]	Concentrates	Total	Iron content, natural (percent)	Direct shipping ore	Sinter [1]	Concentrates	Total	Iron content, natural (percent)
Mined ore:										
Alabama	6,350,152	1,074,815	1,425,567	8,850,534	36.77	5,922,606	1,077,721	1,057,058	8,057,385	36.16
Arizona	345			345	58.00	261			261	55.00
Arkansas						144			144	55.44
California	95,107			95,107	56.30	778,640		5,186	783,826	56.08
Colorado								39	39	49.20
Georgia	4,579		293,941	298,520	47.28	2,430		411,038	413,468	45.53
Michigan	15,624,161			15,624,161	51.68	15,425,788			15,425,788	51.76
Minnesota	56,492,132	269,137	17,176,177	73,937,446	52.11	54,031,870	211,173	14,841,864	69,084,907	51.94
Missouri	47,403		5,436	52,839	49.74	52,699			52,699	52.07
Nevada						7,368			7,368	62.98
New Jersey	95,824		508,227	604,051	62.89	166,887		353,804	520,691	62.68
New Mexico	95,809			95,809	54.85	41,744			41,744	54.83
New York	143,903	1,718,457	653,095	2,515,455	65.95	151,004	1,849,969	945,911	2,946,884	64.08
Pennsylvania					55.19					56.90
South Dakota						1,678			1,678	40.00
Texas	226		16,182	16,408	52.51	1,200			1,200	50.00
Virginia					37.41	109		7,774	7,883	37.25
Utah	321,034			321,034	53.49	922,959			922,959	53.69
Washington	11,861			11,861	61.33	13,446			13,446	30.17
Wisconsin	1,502,587			1,502,587	52.65	1,498,749			1,498,749	52.58
Wyoming	957,027			957,027	49.89	814,203			814,203	52.19
	81,742,150	3,062,409	20,078,625	104,883,184	51.00	79,833,785	3,138,863	17,622,674	100,595,322	51.00
Byproduct ore: [2]										
Delaware		643,011		643,011	61.89		652,513		652,513	63.10
Michigan					65.91					66.00
Pennsylvania					62.66					63.45
Tennessee					67.20					67.30
Virginia					54.10					59.00
		643,011		643,011	63.74		652,513		652,513	64.32
Total	81,742,150	3,705,420	20,078,625	105,526,195	51.08	79,833,785	3,791,376	17,622,674	101,247,835	51.08

[1] Exclusive of sinter produced at consuming plants.

[2] Cinder and sinter obtained from pyrite treated in, but not necessarily mined in, States indicated.

Iron ore mined in the United States, 1942-43, by States and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1942				1943			
	Hematite	Brown ore	Magnetite	Total	Hematite	Brown ore	Magnetite	Total
Alabama	7, 629, 563	1, 220, 971		8, 850, 534	7, 118, 565	938, 820		8, 057, 385
Arizona	345			345	261			261
Arkansas							144	144
California	[1] 81, 719		[1] 13, 388	95, 107	683, 751		100, 075	783, 826
Colorado						39		39
Georgia	4, 579	293, 941		298, 520	2, 430	411, 038		413, 468
Michigan	15, 624, 161			15, 624, 161	15, 425, 788			15, 425, 788
Minnesota	73, 878, 273	59, 173		73, 937, 446	68, 864, 480	220, 427		69, 084, 907
Missouri	6, 192	46, 647		52, 839	5, 094	47, 605		52, 699
Nevada					942		6, 426	7, 368
New Jersey			604, 051	604, 051			520, 691	520, 691
New Mexico	16, 635		79, 174	95, 809			41, 744	41, 744
New York	1, 949		2,513,056	[2] 2, 515, 455			2, 946, 267	[3] 2, 946, 884
Pennsylvania								
South Dakota						1, 678		1, 678
Texas		16, 408		16, 408	1, 200			1, 200
Virginia						7, 883		7, 883
Utah			321, 034	321, 034			922, 959	922, 959
Washington	1, 561		10, 300	11, 861	2, 571		10, 875	13, 446
Wisconsin	1, 502, 587			1, 502, 587	1, 498, 749			1, 498, 749
Wyoming	957, 027			957, 027	814, 203			814, 203
	99, 704, 591	1, 637, 140	3, 541, 003	[2] 104, 883, 184	94, 418, 034	1, 627, 490	4, 549, 181	[3] 100, 595, 322
Byproduct ore: [4]								
Delaware				643, 011				652, 513
Michigan								
Pennsylvania								
Tennessee								
Virginia								
Grand total	99, 704, 591	1, 637, 140	3, 541, 003	[2] 105, 526, 195	94, 418, 034	1, 627, 490	4, 549, 181	[3] 101, 247, 835

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[1] Small quantity of magnetite included with hematite.
[2] Includes 450 tons of carbonate ore.
[3] Includes 617 tons of carbonate ore.
[4] Cinder and sinter obtained from pyrite treated in, but not necessarily mined in, States indicated.

Shipments of iron ore in the United States, 1942, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Iron and steel			Cement	Paint	Miscellaneous	Total	
	Direct shipping ore	Sinter [1]	Concentrates				Gross tons	Value
Mined ore:								
Alabama	6,348,048	1,074,815	1,422,283	--------	--------	--------	8,845,146	$19,034,753
Arizona	345	----------	----------	--------	--------	--------	345	(2)
Arkansas	----------	----------	----------	--------	--------	--------	----------	----------
California	18,094	----------	----------	62,008	--------	12,773	92,875	239,429
Colorado	----------	----------	----------	--------	--------	--------	----------	----------
Georgia	4,429	----------	293,941	--------	--------	--------	298,370	722,013
Michigan	16,129,474	----------	----------	--------	--------	--------	16,129,474	45,599,536
Minnesota	56,417,526	269,137	17,178,502	--------	--------	--------	73,865,165	179,752,236
Missouri	47,889	----------	6,452	--------	355	882	55,578	177,587
Nevada	----------	----------	----------	--------	--------	--------	----------	----------
New Jersey	95,675	----------	491,811	2,545	13,236	93	603,360	3,672,750
New Mexico	95,809	----------	----------	--------	--------	--------	95,809	299,097
New York }	136,221	1,722,000	612,544	--------	2,398	--------	2,473,163	16,750,627
Pennsylvania }								
South Dakota	----------	----------	----------	--------	--------	--------	----------	----------
Texas }	20	----------	----------	--------	10,281	7,061	17,362	(2)
Virginia }								
Utah	319,834	----------	----------				319,834	(2)
Washington	----------	----------	----------	1,551	--------	10,300	11,851	(2)
Wisconsin	1,548,294	----------	----------	--------	--------	--------	1,548,294	3,936,590
Wyoming	957,027	----------	----------	--------	--------	--------	957,027	(2)
Undistributed	----------	----------	----------	--------	--------	--------	----------	[3] 5,756,622
	82,118,685	3,065,952	20,005,533	66,104	26,270	31,109	105,313,653	275,941,240
Byproduct ore: [4]								
Delaware }	----------	674,861	----------	--------	--------	--------	674,861	3,237,511
Michigan }								
Pennsylvania }								
Tennessee }								
Virginia }								
Grand total	82,118,685	3,740,813	20,005,533	66,104	26,270	31,109	105,988,514	279,178,751

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[1] Exclusive of sinter produced at consuming plants.

[2] Value included with "Undistributed."

[3] Includes values for States entered as "(2)."

[4] Cinder and sinter obtained from pyrite treated in, but not necessarily mined in, States indicated.

Shipments of iron ore in the United States, 1943, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Iron and steel			Cement	Paint	Miscellaneous	Total	
	Direct shipping ore	Sinter [1]	Concentrates				Gross tons	Value
Mined ore:								
Alabama	5,928,562	1,076,135	1,055,776				8,060,473	21,047,231
Arizona	261						261	(2)
Arkansas	144						144	(2)
California	636,421					92,389	728,810	1,981,400
Colorado			39				39	(2)
Georgia	1,707		410,801		951		413,459	950,211
Michigan	14,510,357						14,510,357	40,258,096
Minnesota	53,681,586	211,173	14,733,796	1,868	5,549	752	68,634,724	168,536,802
Missouri	46,808				3,085	3,000	52,893	153,997
Nevada	2,140					5,228	7,368	37,856
New Jersey	166,685		345,655	1,303	360	7,792	521,795	3,584,229
New Mexico	41,744						41,744	104,076
New York	158,300	1,851,117	657,302	520		28,996	2,697,231	19,917,767
Pennsylvania					996			
South Dakota					1,678		1,678	(2)
Texas	300				13,505	1,019	14,824	(2)
Virginia								
Utah	910,747			1,092			911,839	(2)
Washington				2,580		10,875	13,455	(2)
Wisconsin	1,392,173						1,392,173	3,822,025
Wyoming	814,203						814,203	(2)
Undistributed								[3] 5,385,243
	78,292,138	3,138,425	17,203,369	7,363	26,124	150,051	98,817,470	265,778,933
Byproduct ore: [4]								
Delaware		645,380					645,380	3,237,613
Michigan								
Pennsylvania								
Tennessee								
Virginia								
Grand total	78,292,138	3,783,805	17,203,369	7,363	26,124	150,051	99,462,,850	269,016,546

[1] Exclusive of sinter produced at consuming plants.

[2] Value included with "Undistributed."

[3] Includes values for States entered as "(2)."

[4] Cinder and sinter obtained from pyrite treated in, but not necessarily mined in, States indicated.

PRINCIPAL MINES

In this discussion, the size of a mine is determined by the quantity of crude ore excavated. Consequently, mines providing low-grade ores, which require concentration, will be comparable in size to mines producing similar quantities of direct shipping ores. Twenty-five mines, each yielding more than 1,000,000 gross tons of crude ore, produced 52 percent of the United States output in 1943. Of these producers, 18 were in Minnesota, 3 in Alabama, 2 in New York, and 1 each in Wisconsin and Pennsylvania; 15 were open-pit operations, 7 underground, and 3 combination mines. Except for 3 mines that produced magnetite, all the million-ton mines produced hematite.

Iron-ore mines in the United States in 1943, by size of crude output

Name of mine	State	Nearest town	Range or district	Mining method	Production (gross tons)	
					Crude ore	Usable ore
Hull-Rust-Burt-Sellers-Penobscot	Minnesota	Hibbing	Mesabi	Open pit	19, 421, 349	19, 421, 349
Hill Annex	do	Calumet	do	do	4, 288, 553	2, 854, 447
Rouchleau	do	Virginia	do	do	3, 806, 468	3, 806, 468
Mountain Iron	do	Mountain Iron	do	do	2, 897, 201	2, 897, 201
Adams Spruce	do	Eveleth	do	Combined	2, 676, 386	2, 676, 386
Mahoning	do	Hibbing	do	Open pit	2, 517, 601	2, 517, 601
Frazer D'Autremont	do	Chisholm	do	do	1, 792, 275	1, 792, 275
Wenonah	Alabama	Bessemer	Birmingham	Underground	1, 722, 393	4, 656, 120
Muscoda	do	do	do	do	1, 651, 806	
Ishkooda	do	do	do	do	1, 362, 563	
Kevin	Minnesota	Nashwauk	Mesabi	Open pit	1, 570, 890	806, 510
Hill-Trumbull	do	Marble	do	do	1, 439, 812	916, 913
Leonard-Burt-Glen	do	Chisholm	do	do	1, 437, 014	1, 437, 014
Mississippi	do	Nashwauk	do	Underground	1, 325, 658	928, 440
Morris	do	Hibbing	do	Combined	1, 317, 740	1, 317, 740
Scranton	do	do	do	Open pit	1, 283, 629	1, 283, 629
Gross Marble	do	Marble	do	do	1, 244, 100	702, 469
Holman-Brown	do	Taconite	do	do	1, 168, 946	775, 142
Canisteo	do	Coleraine	do	do	1, 125, 107	585, 016
Montreal	Wisconsin	Montreal	Gogebic	Underground	1, 120, 793	1, 120, 793
Arcturus	Minnesota	Marble	Mesabi	Open pit	1, 034, 706	514, 852
Morrison	do	Coleraine	do	do	1, 001, 933	798, 787
Missabe Mountain	do	Franklin	do	do	996, 581	996, 581
Hawkins	do	Nashwauk	do	do	978, 197	574, 532
Argonne	do	do	do	do	972, 242	481, 150
Negaunee	Michigan	Negaunee	Marquette	Underground	954, 990	954, 990
Hartley	Minnesota	Fraser	Mesabi	Open pit	929, 052	929, 052
Danube	do	Coleraine	do	do	923, 578	616, 271
Woodward No. 3	Alabama	Bessemer	Birmingham	Underground	901, 041	901, 041
Bennett	Minnesota	Keewatin	Mesabi	Combined	898, 513	848, 816
Susquehanna	do	Hibbing	do	Open pit	887, 559	887, 559
Davis-Geneva-West Davis	Michigan	Ironwood	Gogebic	Underground	851, 884	851, 844
Mitchell & Hodge Group	Georgia	Taylorsville	Chattanooga	Open pit	850, 000	212, 118
Harrison	Minnesota	Cooley	Mesabi	do	846, 933	349, 120
Webb	do	Hibbing	do	Combined	835, 625	770, 137
Zenith	do	Ely	Vermilion	Underground	834, 539	834, 539
Sunrise	Wyoming	Sunrise	Hartville	do	814, 203	814, 203
Scrub Oaks	New Jersey	Dover	New Jersey	do	767, 291	243, 348
Buck	Michigan	Caspian	Menominee	do	756, 287	756, 287
Alpena (stock pile)	Minnesota	Virginia	Mesabi	Open pit	728, 658	728, 658
Russellville Nos. 5 and 12	Alabama	Russellville	Russellville	do	723, 294	84, 197
Maas	Michigan	Negaunee	Marquette	Underground	713, 069	713, 069

Iron-ore mines in the United States in 1943, by size of crude output—Continued

Name of mine	State	Nearest town	Range or district	Mining method	Production (gross tons)	
					Crude ore	Usable ore
Cornwall	Pennsylvania	Cornwall	Cornwall	Combined	5, 468, 661	2, 792, 751
Chateaugay	New York	Lyon Mountain	Adirondack	Underground		
Harmony-Old Bed	do	Mineville	do	do		
MacIntyre	do	Tahawus	do	Open pit		
Output of 46 mines producing more than 700,000 tons of crude ore each					79, 839, 080	68, 149, 415
Output of 10 mines producing 600,000 to 700,000 tons of crude ore each					6, 349, 046	4, 569, 808
Output of 13 mines producing 500,000 to 600,000 tons of crude ore each					7, 144, 404	6, 557, 972
Output of 12 mines producing 400,000 to 500,000 tons of crude ore each					5, 416, 494	4, 958, 197
Output of 21 mines producing 300,000 to 400,000 tons of crude ore each					7, 483, 429	6, 260, 966
Output of 22 mines producing 200,000 to 300,000 tons of crude ore each					5, 539, 156	4, 909, 398
Output of 35 mines producing 100,000 to 200,000 tons of crude ore each					4, 947, 209	3, 531, 388
Output of 18 mines producing 50,000 to 100,000 tons of crude ore each					1, 337, 927	715, 900
Output of 110 mines producing under 50,000 tons of crude ore each					1, 273, 737	765, 015
Output from reprocessed tailings (2 plants)					344, 498	177, 263
Grand total of United States (287[1] mines and 2 reprocessing plants)					119, 674, 980	100, 595, 322

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[1] Excludes an undetermined number of small pits. The output of these pits is included in the total given.

BENEFICIATION

Iron ore is concentrated by washing, jigging, and magnetic and high-density separation to remove objectionable impurities, thereby improving the grade of ore. Fine ores are agglomerated or sintered into lumps, which are desirable in blast and steel furnaces because of their porous character and their improved grade and structure. Sintering likewise has the beneficial effect of reducing the sulfur and moisture content. At many mines the ore is crushed and screened to improve its physical characteristics, but ore known to be so improved is not included in the statistics on beneficiated ore.

In 1943 a total of 20,761,537 gross tons of beneficiated ore was produced from 40,199,797 tons of crude ore. Beneficiation of iron ore was reported at 132 mines in nine states in 1943 compared with 120 mines in nine States in 1942. Beneficiated ore shipped from domestic mines in 1943 decreased 12 percent from 1942; concentrates comprised 17 percent and sinter 3 percent of total usable ore shipments.

The production of beneficiated ore, concentrates, and sinter in 1943 decreased 10 percent from 1942, chiefly owing to efforts of companies in the Lake Superior district to ship as large a tonnage of direct shipping ore as possible, thereby meeting shipping quotas with a minimum of manpower output. The ratio of crude ore used to usable ore produced was 1.936:1 in 1943 compared with 1.927:1 in 1942.

The beneficiation of low-grade iron ores aroused increased interest during the year, as various operating companies started individual and cooperative research, in addition to programs which have been under way for a number of years. Interest centered primarily on the low-grade ores, including taconite, in the Lake Superior district (see review of Lake Superior District). The magnetic taconites at the eastern end of the Mesabi range are easier to separate than the bulk of the ore which is nonmagnetic and requires a special roasting process. The iron oxide contained in both types is finely divided, necessitating fine crushing.

Experimental work is not only being conducted with regard to magnetic separation, but efforts are also being continued to improve the high-density or heavy-media method, which originated with the Chance process for sand flotation of coal in 1931. In 1936–37 the first iron and manganiferous iron ores were successfully treated by this technique at the Mines Experiment Station, University of Minnesota. Since that time the high-density treatment of iron ore has supplied a small quantity of hematite concentrates annually.

Preparations were under way in 1943 for the first commercial high-density concentration of brown ore. The Merritt plant on the Mesabi range has been dismantled to be reerected at the Scotia mine, Pennsylvania, for this purpose. This operation is scheduled for production in 1944.

Heavy-media separation processes are described in a paper[3] published by the American Cyanamid Co., in 1943.

The briquetting of soft iron ore attracted attention during the year as a patent was granted covering a process for the preparation of soft ores for satisfactory furnace use. In steel furnaces briquets are designed for use as a substitute for lump ore, either for charging or finishing. In blast furnaces briquets would lower dust losses, permit easier flowage of furnace gases, and generally provide a more acceptable burden in contrast to soft ores. Although briquetting is not common, it has been done to some extent in the past. With regard to Carnegie-Illinois practice, Reinartz[4] has stated:

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[3] American Cyanamid Co., Heavy-Media Separation Processes, Fine Ore Concentration: Ore Dressing Notes, No. 12, August 1943, 16 pp.

> We have for years briquetted soft ore in a jarring machine by the use of 2 percent or less of cement as a binder. We then burn these briquets for 20 to 30 minutes in the open-hearth furnace at the time of charge to remove the combined moisture.

Statistics covering production of iron-ore briquets are not available.

Iron ore shipped from mines in the United States, 1925–29 (average) and 1939–43, in gross tons, and percentage of beneficiated ore compared to total shipped

[Exclusive of ore containing 5 percent or more manganese and ore sold for paint]

Year	Beneficiated	Total	Proportion of beneficiated to total (percent)	Year	Beneficiated	Total	Proportion of beneficiated to total (percent)
1925–29 (av.)	8,653,590	66,697,126	13.0	1941	19,376,120	93,053,994	20.8
1939	9,425,809	54,827,100	17.2	1942	[1] 23,104,945	[1] 105,313,653	21.9
1940	12,925,741	75,198,084	17.2	1943	[1] 20,117,685	[1] 98,817,470	20.4

[1] Includes ore for paint.

SINTER

Domestic sintering plants in 1943 used 10,362,946 gross tons of iron ore, 5,188,555 tons of flue dust, 286,876 tons of mill cinder and roll scale, 648,592 tons of pyrite cinder (including a small quantity of flue dust and iron ore not separated), and 15,756 tons of manganese-bearing ore to produce 14,467,018 tons of sinter—a yield of 88 percent.

Sinter production in 1943 came from plants at mines, blast-furnace plants, custom mills, and a number of rotary cement kilns converted to iron-ore roasting. Of the sinter produced in the United States in 1943, 22 percent was made at mine plants in 4 States, and 78 percent was produced at blast-furnace plants and custom mills in 16 States. In addition, a number of other sintering plants were under construction and are expected to be in production in 1944. Total sintering capacity on July 1, 1942, was listed at 14,617,000 tons; wartime expansion will raise capacity to 23,826,000 tons. Agnew[5] has described the development, use, process, and plant design, with regard to sinter production. Thyrre[6] has described the use of rotary kilns for the agglomeration of ores. A bibliography covering the sintering of iron ore and blast-furnace flue dust has been prepared by Filar.[7]

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[4] Iron Age, Sintering Practice for Open-Hearth Ores: Vol. 151, No. 8, February 25, 1943, p. 57.

[5] Agnew, Charles E., Sinter, Its Development and Use: Steel, No. 22, vol. 112, May 31, 1943, p. 84.

[6] Thyrre, S. G., Rotary Kilns for Agglomerating Ores: Steel, No. 1, vol. 113, July 5, 1943, p. 116.

[7] Filar, Leo, Sintering of Iron Ore and Blast-Furnace Flue Dust; a Bibliography: Blast Furnace and Steel Plant, No. 11, vol. 31, November 1943, p. 1262.

Production and consumption of sinter in the United States in 1943 by States, in gross tons

State	Sinter produced	Sinter consumed	
		In blast furnaces	In steel furnaces
Alabama	1,599,887	1,606,410	80,558
California Colorado Utah	443,895	422,573	11,983
Delaware	(1)	-----	-----
Illinois	652,096	645,925	6,814
Indiana	1,009,959	833,588	163,486
Kentucky Maryland Tennessee West Virginia	378,982	413,163	27,978
Michigan Minnesota	558,210	285,861	68,173
New York	2,388,051	708,247	138,517
Ohio	3,289,787	3,427,644	434,084
Pennsylvania	4,146,151	3,258,788	399,087
	14,467,018	11,602,199	1,330,680

[1] Included with Pennsylvania.

AVERAGE VALUE

The average value per gross ton of iron ore at the mine was $2.70 in 1943 compared with $2.63 in 1942.

The accompanying table gives the average value at the mines of the different classes of iron ore in 1943 for each of the producing

Average value per gross ton of iron ore at mines in the United States, 1942–43

[Exclusive of ore containing 5 percent or more manganese]

State	1942							1943						
	Direct			Concentrates				Direct			Concentrates			
	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter
Mined ore:														
Alabama	$2.05	-----	-----	(1)	$2.50	-----	(1)	$2.43	-----	-----	(1)	$2.74	-----	(1)
California	2.34	-----	(1)	-----	-----	-----	-----	(1)	-----	(1)	-----	-----	(1)	-----
Georgia	(1)	-----	-----	-----	2.40	-----	-----	(1)	-----	-----	-----	2.29	-----	-----
Michigan	2.83	-----	-----	-----	-----	-----	-----	2.77	-----	-----	-----	-----	-----	-----
Minnesota	2.40	-----	-----	$2.41	(1)	-----	$2.50	2.44	-----	-----	$2.52	(1)	-----	$2.84
Missouri	4.69	(1)	-----	-----	(1)	-----	-----	3.52	(1)	-----	-----	-----	-----	-----
New Jersey	-----	-----	(1)	-----	-----	$5.89	-----	-----	-----	(1)	-----	-----	$6.86	-----
New Mexico	4.32	-----	$2.87	-----	-----	-----	-----	-----	-----	$2.49	-----	-----	-----	-----
New York Pennsylvania	(1) -----	----- -----	(1) (1)	----- -----	----- -----	4.57	7.36	----- -----	----- -----	(1) -----	----- -----	----- -----	5.19	8.37
Wisconsin	2.54	-----	-----	-----	-----	-----	-----	2.75	-----	-----	-----	-----	-----	-----
Other [2]	4.50	(1)	3.35	-----	(1)	-----	-----	2.78	$4.07	3.17	-----	9.02	-----	-----
Average, all States	2.51	$2.98	5.06	2.43	2.64	5.17	4.59	2.51	3.02	3.84	2.55	2.58	5.77	6.20
Byproduct ore: [3]														
Delaware Michigan Pennsylvania Tennessee Virginia	-----	-----	-----	-----	-----	-----	4.80	-----	-----	-----	-----	-----	-----	5.02

[1] Included with average for all States.

[2] Includes Arizona, Texas, Utah, Virginia, Washington, and Wyoming in 1942, and these States plus Arkansas, Colorado, South Dakota, and California in 1943.

[3] Cinder and sinter obtained from pyrite treated in, but not necessarily mined in, States indicated.

States or groups of States, except when there are fewer than three shippers of a certain class of ore in a State and permission was not given to publish the value. These data are taken directly from statements of producers and probably represent the commercial selling prices only approximately, as not all reports are comparable. Some evidently include mining costs only; others contain, in addition, the cost of selling and insuring the ore; others include an allowance for a sinking fund; and still others comprise only costs charged against blast furnaces. None of the reports, however, is supposed to include freight charges.

CONSUMPTION

A total of 100,273,451 gross tons of metallurgical iron ore was reported consumed in 1943. Of this, 85 percent was consumed in iron blast furnaces, 10 percent in sintering plants, 4 percent in steel furnaces, and 1 percent in ferro-alloy furnaces. The 183,538 tons of miscellaneous ore shipped from mines and mills in 1943 were assumed to have gone directly into consumption.

The tables giving consumption of all metalliferous materials in the production of pig iron, formerly included in this section, will be found in the chapter Pig Iron, Ferro-Alloys, and Steel.

Consumption of iron ore in the United States, 1943, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Metallurgical uses				Miscellaneous uses [1]			Total
	Iron blast furnaces	Steel furnaces	Sintering plants	Ferro-alloy furnaces	Cement	Paint	All other	
Alabama	6,805,272	26,653	1,314,740	--------	--------	--------	--------	8,146,665
California	1,591,819	65,590	491,498	245	1,092	--------	92,389	2,242,633
Colorado								
Utah								
Georgia	--------	--------	--------	--------	--------	951	--------	951
Illinois	8,974,929	369,223	286,078	--------	--------	--------	--------	9,630,230
Indiana	10,424,771	729,414	449,167	--------	--------	--------	--------	11,603,352
Kentucky	4,500,588	440,356	5,058	--------	--------	--------	--------	4,946,002
Maryland			--------	--------	--------	--------	--------	
Massachusetts		--------	--------	--------	--------	--------	--------	
Michigan	2,211,638	52,854	168,289	--------	--------	--------	--------	2,432,781
Minnesota	904,896	54,517	[2] 211,173	--------	1,868	5,549	752	1,178,755
Missouri	--------	--------	--------	--------	--------	3,085	3,000	6,085
Nevada	--------	--------	--------	--------	--------	--------	5,228	5,228
New Jersey	--------	--------	--------	--------	1,303	360	7,792	9,455
New York	5,751,247	377,251	2,219,095	225,639	520	--------	28,996	8,602,748
Ohio	17,569,951	773,772	2,307,046	294,188	--------	--------	--------	20,944,957
Pennsylvania	24,456,847	1,222,395	2,910,802	8,424	--------	996	--------	28,599,464
South Dakota	--------	--------	--------	--------	--------	1,678	--------	1,678
Virginia	2,063,965	--------	--------	--------	--------	13,505	1,019	2,092,550
West Virginia		14,061	--------	--------	--------			
Texas	--------		--------	--------	--------			
Washington	--------	--------	--------	--------	2,580	--------	10,875	13,455
	85,255,923	4,126,086	10,362,946	528,496	7,363	26,124	150,051	100,456,989

[1] Shipments from domestic mines.

[2] Exact consumption in Minnesota not known; estimated equal to sinter production.

STOCKS OF IRON ORE

Stocks of iron ore at mines on December 31, 1943, increased 54 percent from 1942. Of the quantity in stock piles, 52 percent was at mines in Michigan, 36 percent in Minnesota, and 5 percent in

Wisconsin—a total of 93 percent at mines in the Lake Superior district.

Stocks of crude ore at mines totaled 3,934,316 gross tons on December 31, 1943, compared with 2,674,606 tons in 1942.

Stocks of iron ore at consuming plants totaled 38,337,616 gross tons on December 31, 1943, compared with 40,766,573 tons at the end of 1943. The decrease was the result of the decreased Lake shipments during the 1943 season. The distribution of stocks at the end of 1943 was more favorable than in the previous year as a result of informal allocation of 1943 shipments to assure satisfactory stocks at all consuming plants to meet the 1944 shipping season.

Stocks of iron ore at mines, December 31, 1942–43, by States, in gross tons

State	1942	1943	State	1942	1943
Alabama	29,507	24,833	New York	55,337	310,122
California	2,232	57,248	Pennsylvania	12,816	7,415
Georgia	150	22	Texas	5,906	900
Michigan	1,705,329	2,665,567	Utah	1,200	11,720
Minnesota	1,333,331	1,856,270	Virginia	3,910	393
Missouri	1,446	106	Wisconsin	164,414	233,426
New Jersey	51,269	1,503		3,366,847	5,169,525

FOREIGN TRADE

Because of the wartime shipping shortage imports of iron ore continued to decrease in 1943.

Iron ore imported for consumption in the United States, 1941–43, by countries, in long tons

Country	1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value
Algeria					89,766	$443,744
Brazil	118,870	$479,122	47,600	$188,908		
Canada [1]	[1] 280,236	[1] 1,182,566	[1] 256,265	[1] 1,145,431	[1] 279,222	[1] 1,229,520
Chile	1,685,780	3,064,838	383,330	689,998		
Cuba	180,088	359,863	41,165	83,504		
Mexico	4,445	9,669	2,418	6,974	16,740	59,680
Morocco, French					13,074	77,354
Newfoundland and Labrador	57,026	159,017				
Oceania, French					2	10
Philippine Islands	9,700	22,254	9	75		
Spain	7,292	50,755				
United Kingdom [2]	546	19,193	538	27,679	313	16,725
	2,343,983	5,347,277	731,325	2,142,569	399,117	1,827,033

[1] Includes pyrite cinder.
[2] United Kingdom of Great Britain and Northern Ireland.

Exports of iron ore from the United States in 1943 totaled 2,424,801 gross tons valued at $8,117,156 ($3.35 a ton) compared with 2,515,388 tons valued at $8,114,586 ($3.23 a ton) in 1942. Of the total quantity of iron ore exported in 1943 Canada received 2,424,738 tons, Mexico 50 tons, Colombia 10 tons, and Australia 2 tons.

REVIEW OF LAKE SUPERIOR DISTRICT

Production and shipments.—Production of iron ore from mines in the Lake Superior district in 1943 was 6 percent lower than in the record year 1942 and supplied 85 percent of the Nation's output compared with 87 percent in 1942. The Mesabi was again the largest of the six producing ranges, supplying 76 percent of the district total and 65 percent of the United States total. The Lake Superior iron-ore data do not include 1,433,166 tons of ore containing 5 percent and more manganese.

The Lake Superior Iron Ore Association reported 83,946,827 tons of iron and manganiferous ore shipped down the Great Lakes from United States ports in 1943—a decrease of 8 percent from 1942. All-rail shipments, which totaled 2,015,341 tons in 1943, were made to blast furnaces for use in making pig iron and to industrial plants for paint, sashweights, and ballast.

Before the season opened the War Production Board set a quota of 95,000,000 tons of ore to be shipped down the Lakes in 1943. It was hoped that additions to the fleet would permit this goal to be reached. However, this quota was subsequently revised downward to 86,500,000 tons because of several contingencies. The 1943 season did not get underway on Lake Michigan until April 4, when the first loaded ore carriers left Escanaba, whereas in 1942 ore shipments started from Escanaba on March 23. The first ore carrier passed southward through the locks at Sault Ste. Marie on April 28, 1943—about a month later than in 1942. Shipments during the first few weeks of the season were retarded by heavy fogs and rain. Collisions sunk two ore carriers, and several others were damaged. Sixteen new maritime vessels were added to the fleet during the season; however, most of these were completed behind schedule. In both 1942 and 1943 the last shipments of ore were made early in December. At the end of the season the United States ore fleet comprised 319 vessels having a trip capacity rated at 2,984,490 tons (at 20 feet draft); 28 Canadian vessels were also in the ore trade.

Iron ore produced in the Lake Superior district, 1854–1943, by ranges, in gross tons

[Exclusive after 1905 of ore containing 5 percent or more maganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1941	213,048,628	191,272,379	225,607,448	70,520,400	1,178,414,192	27,987,266	1,906,850,313
1942	6,324,307	4,808,866	5,993,575	1,935,125	70,287,664	1,655,484	91,005,021
1943	5,680,727	5,366,595	5,877,215	1,782,237	65,334,939	1,747,304	85,789,017
Total	225,053,662	201,447,840	237,478,238	74,237,762	1,314,036,795	31,390,054	2,083,644,351

The new MacArthur lock was opened to ore traffic on July 11. This is now the largest lock at Sault Ste. Marie and should prove a valuable addition to the Great Lakes waterway.

Construction was started on a new emergency loading dock at Escanaba, Mich., in 1942, but was abandoned in 1943. Structural timber work was completed early in the year; however, track and chutes were not provided. Enough was accomplished to enable the dock to serve in an emergency, for it should be a relatively easy task to install necessary facilities when completion seems advisable.

Mining developments.—Three large new strip mines on the Mesabi range were developed during the year—the Embarrass, Longyear, and Columbia. However, only the Columbia, operated by the Interstate Iron Co., was able to ship ore in 1943. The Evergreen Mines Co. constructed two new beneficiation plants during the year. A washing plant built at the Buckeye mine on the western side of the Mesabi range has a daily capacity of 4,000 tons, and another of 3,000 tons capacity was constructed at the Douglas mine. Milling equipment for these plants came from Evergreen's Draper mine. The draining of 2 billion gallons of water from the Fayal mine at the Oliver Iron Mining Co., a subsidiary of the United States Steel Corporation, was started during the year in preparation for production during 1944. This mine, which has not been worked since 1933, is estimated to contain 8,026,038 tons of unmined ore. The Oliver Iron Mining Co. brought the Mountain Iron mine into production after 34 years of inactivity. A new ore producer on the Menominee range in 1943 was the Book open-pit mine, operated by the North Range Mining Co. At the Republic Steel Corporation Susquehanna mine on the Mesabi range, new 15-ton trucks were put into use to remove surface and rock stripping. These trucks eventually will be used to transport ore, replacing the electric haulage system now in use at the pit. Preparations were being made to install a crusher and belt-conveyor system at this mine. The new Mather mine, operated by the Cleveland-Cliffs Co., on the Marquette range, came into production in 1943. A 30-inch ventilation borehole was drilled to a depth of 1,000 feet at the Sherwood mine, and a 66-inch shot-drilled ventilation hole at the Cary was down to about a 2,000-foot depth at the end of the year. This latter hole will be completed at 2,585 feet and eventually will be enlarged to make a hoisting shaft. The Davidson No. 2 mine of the Pittsburg Coke & Iron Co. became exhausted in April 1943 after 33 years of production.

Average costs, per gross ton, of mining iron ore at underground mines and at siliceous open pits in Michigan in 1943 [1]

Item	Underground				Siliceous open pits
	Gogebic	Marquette	Menominee	Average	
Cost of mining:					
Labor	$1.2716	$1.5658	$1.1942	$1.3504	$0.2842
Supplies	.5953	.6193	.5667	.5937	.2614
Deferred costs	.2232	.0496	.1348	.1282	.0446
Taxes	.2185	.1783	.0989	.1607	.0614
General overhead	.1887	.2056	.1617	.1903	.1137
Transportation	1.8890	1.5898	1.6486	1.7032	1.5733
Marketing	.0610	.0968	.0804	.0813	.0871
Total ore cost	4.4473	4.3052	3.8853	4.2078	2.4257
Lake Erie value per ton	4.7745	4.6558	4.3633	4.5877	2.3540
Gross ore profit [2]	.3272	.3506	.4780	.3799	−.0717
Other costs:					
Royalty	.3473	.2193	.2544	.2665	.1076
Interest on borrowed money	.0005	.0322	.0025	.0127	.0201
Federal income and excess profits	.1693	.0739	.1105	.1127	.0784

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[1] Pardee, F. G., General Statistics Covering Costs and Production of Michigan Iron Mines: Michigan Dept. of Conservation, Geol. Survey Div., 1944, 9 pp.

[2] This figure does not represent true profit, as much ore is sold below the Lake Erie price.

Analyses.—The following table was compiled by the Lake Superior Iron Ore Association.

Average analyses of total tonnages (bill-of-lading weights) of all grades of iron-ore from all ranges of Lake Superior district, 1939–43

Year	Gross tons	Iron (natural)	Phosphorus	Silica	Manganese	Moisture
		Percent	*Percent*	*Percent*	*Percent*	*Percent*
1939	44,983,754	51.75	0.085	8.27	0.76	10.73
1940	63,308,413	52.09	.085	8.00	.77	10.93
1941	79,941,240	51.83	.085	8.18	.78	11.01
1942	92,069,902	51.65	.089	8.21	.79	10.98
1943	85,116,347	51.58	.091	8.32	.82	11.06

Stocks at Lake Erie ports.—On December 1, 1943, just before navigation stopped, the Lake Superior Iron Ore Association reported 6,393,581 tons of iron ore at Lake Erie ports compared with 7,151,439 tons on the same date in 1942. At the opening of the 1944 season (May 1, 1944), 2,906,827 tons of ore were in stock at these ports compared with 2,814,990 tons on May 1, 1943. Withdrawals from stocks during this 5-month period in 1943–44 were 20 percent less than in 1942–43.

Prices of Lake Superior ore.—The prices established April 17, 1940, for the four standard grades of Lake Superior ore remained unchanged. Since that date the prices of the various grades quoted at Lake Erie ports for a long-ton unit were as follows: Old-Range Bessemer, 9.223 cents; Mesabi Bessemer, 8.932 cents; Old-Range Nonbessemer, 8.932 cents; and Mesabi Nonbessemer, 8.641 cents; respectively, $4.75, $4.60, $4.60, and $4.45 a gross ton. The base of the four standard grades for 1925–43 is an iron content of 51.50 percent natural. For the Bessemer grades, the allowable phosphorus content is 0.045 percent (dry), and for the nonbessemer grades the phosphorus content ranges from 0.045 to 0.18 percent. Ores containing more than 0.18 percent phosphorus are classed as high-phosphorus ores, whereas those containing 18 percent or more silica are classed as siliceous ores.

Reserves.—Considerable interest in low-grade iron ores was shown during the year by several Minnesota operating companies. Within the past few years, apprehension over the rapid decline of their ore reserves has prompted various companies to compete in the leasing of State and privately owned lands containing these low-grade ores. Other deposits of high-grade ore, which are small and costly to mine, attracted the attention of the operating companies. When the State offered land in June 6, 1943, 10 of the parcels bid for were lake-bed sites. Of 6 lake-bed prospecting permits issued, 5 were taken by the Evergreen Mines Co. Action on 4 others, the principal one of which was underlying Rabbit Lake, was held up pending settlement between the State and owners of the claimed riparian rights.

During the year the Minnesota State Legislature assisted the iron-ore industry by reducing the ad valorem tax on taconite properties. At the instigation of iron-range legislators, a tax of $1.00 per acre was levied on taconite reserves. When the taconite is mined and concentrated to a usable iron content, a tax will be placed on the concentrate produced. The rate will be determined by the iron content of the concentrate and will average about 6 cents per ton.

Iron-ore reserves in Michigan, January 1, 1940–44, in gross tons

Range	1940	1941	1942	1943	1944
Gogebic	37,160,900	31,603,731	30,073,528	32,901,951	32,791,848
Marquette	49,573,794	48,370,114	48,306,120	50,991,701	49,652,024
Menominee	56,922,733	55,851,786	56,130,084	55,563,724	53,902,631
	143,657,427	135,825,631	134,509,732	139,457,376	136,346,503

Unmined iron-ore reserves in Minnesota, May 1, 1939–43, in gross tons

	1939	1940	1941	1942	1943
Mesabi	1,132,513,348	[1] 1,122,593,116	1,097,000,026	1,069,752,650	1,043,804,381
Vermillion	13,631,484	13,208,699	14,018,934	14,903,353	13,449,980
Cuyuna	61,902,885	65,026,280	65,012,265	64,411,762	63,559,458
Total Minnesota (Lake Superior district)	1,208,047,717	[1] 1,200,828,095	1,176,031,225	1,149,067,765	1,120,813,819
Filmore County	------------	------------	------------	250,000	259,859
	1,208,047,717	1,200,828,095	1,176,031,225	1,149,317,765	1,121,073,678

[1] Revised.

Prospecting.—Some prospecting was accomplished during the year, although most companies, particularly those operating underground mines, were forced to let their development programs fall behind as they concentrated upon production. Pennsylvania oil-drilling derricks were used by the Cleveland-Cliffs Iron Co. for deep core drilling on the Marquette range. Underwater deposits in the Lake Superior district continued to be drilled through the ice during the winter; at Pickands Mather's Rabbit Lake reserve 7,200,000 tons of ore were measured by this method. During the year the Federal Bureau of Mines drilled and trenched deposits on the Gogebic and Marquette ranges.

Research.—A research program sponsored by 12 iron and steel companies was started in 1943 in an effort to find a commercial method of beneficiating low-grade Lake Superior ores. The program, which is being conducted by the Battelle Memorial Institute, will cost about $50,000 annually. The problem of treating taconites and other low-grade ores economically has long been studied at the Minnesota Mines Experiment Station. Independent research on the same problem is being conducted by several companies, including the Oliver Iron Mining Co. and the Pickands Mather Co. The latter company constructed a laboratory and testing plant at Hibbing, Minn., and the Oliver Iron Mining Co. established a laboratory in Duluth. In addition, the research department of the United States Steel Co. has conducted a long-range experimental program for the past 8 years with a view toward conserving natural resources by increasing the use of low-grade iron ore.

MINING BY STATES

Alabama.—Iron-ore production in Alabama during 1943 decreased 9 percent from 1942, principally because of coal strikes, which caused a reduction of pig-iron output at Alabama blast furnaces and thereby lowered the demand for iron ore.

The Red Mountain group of mines—the Ishkooda, Muscoda, and Wenonah—operated by the Tennessee Coal, Iron & Railroad Co. were the largest producers in Alabama during 1943. These underground mines produced hematite, some of which was sintered before consumption, the rest being shipped direct to furnaces. Sinter was also produced at the Republic Steel Corporation's Spaulding mine. Hematite from this mine was concentrated and mixed with pyrite cinder from Virginia and other materials before being sintered. Sinter produced from materials other than iron ore has been excluded from Alabama statistics but has been credited to sinter production at consuming plants.

The Raimund mine of the Republic Steel Corporation near Birmingham was closed during the year owing to exhaustion of its commercial-grade ore. Some 4 or 5 million tons of ore remain unmined, but they occur in thin beds of low-grade material.

Late in the year a settlement of portal-to-portal pay for iron miners in Alabama was taken to the United States Supreme Court. Three companies—the Tennessee Coal, Iron & Railroad Co., Sloss-Sheffield Steel & Iron Co., and Republic Steel Corporation were primarily affected. Late in the year operators of 13 Alabama iron-ore mines, including the three concerns named above, sought a declaratory judgment freeing them from the necessity of paying portal-to-portal wages to approximately 6,000 miners. The controversy concerned the phrase "work week"—whether or not it could be interpreted to mean all time spent underground. The United States Supreme Court handed down the decision on March 27, 1944, that, under the Wage-Hour law, payment is required for portal-to-portal travel time at underground iron-ore mines.

Iron ore, principally brown ore, was purchased from the smaller independent operators by the Republic Steel Corporation; the Tennessee Coal, Iron & Railroad Co., and the Woodward Iron Co. during the early part of the year. However, only Republic provided a market in the latter months. Total production of crude brown ore in Alabama in 1943 decreased 21 percent from 1942. All this ore was washed before shipment for consumption. The ratio of concentration was 5.22:1 in 1943, compared with 5.07:1 in 1942. The Russellville Nos. 5, 11, and 12 and La Grange mines of the Sloss Sheffield Steel & Iron Co., the Giles mine of the Central Iron Ore Co., and the Auxford and Docray mines of the Shook & Fletcher Supply Co. were the large brown-ore producers in the State.

Usable hematite produced in 1943 averaged 35.01 percent Fe, 0.16 percent Mn, 0.32 percent P, 14.95 percent SiO_2, and 15.57 percent CaO. Washed brown ore in 1943 contained 44.87 percent Fe, 0.76 percent Mn, 0.50 percent P, and 11.56 percent SiO_2.

Arizona.—Iron-ore production during 1943 came from two open-cut mines in Yuma County, both operated by E. E. Carlisle. A small quantity of hematite was shipped from these operations to Alhambra, Calif., where it was consumed in acid electric furnaces.

Arkansas.—A small quantity of magnetite from the Magnet Cove mine in Hot Spring County was shipped for consumption in Alabama blast furnaces in 1943.

California.—Iron-ore production in 1943 established a State record, as the output increased eightfold over that in 1942. This large increase in iron-ore output was due to the increased demand for ore by the California pig-iron industry, which experienced its first full year with a modern blast furnace. Most of the ore produced during the year came from the Vulcan mine near Kelso, San Bernardino County, which shipped hematite to the Fontana furnace for consumption. A total of 94,889 tons of magnetite was produced near Redding, Shasta County, which was used as ballast on shipping vessels. Magnetite sand from a deposit near Watsonville, Santa Cruz County, was produced for use as ballast and for roofing paper. This ore is usually graded according to specific gravity.

Property owned by the Southern Pacific Land Co. in northeastern Riverside County was purchased by the Kaiser Co. in 1943. It is situated on the Eagle Mountain ore deposit which Bureau of Mines engineers have estimated to contain 21,629,000 tons of positive ore, 15,000,000 tons of probable ore, and a potential reserve of 70,000,000 tons.[8]

Colorado.—A few tons of brown ore were mined near Salida, Chaffee County, during 1943, and shipped to Pueblo for blast-furnace use.

Georgia.—Most of the Georgia output was brown ore and came from 23 mines in Bartow, Floyd, Polk, and Walker Counties. The mines operated by the Mitchell & Hodge Co. at Taylorsville were the largest producers in the State in 1943. Other important brown-ore mines were operated by the Albea-Baker-York Mining Co., the Arrington Mining Co., the Clemmons Hill Mining Co., and the Lucas Mining Co. Hematite produced during the year came from the Walker's Ridge and Shaw mines in Walker County.

Independent producers in Georgia, like those in Alabama, are directly affected by the Birmingham iron and steel industry. Although iron and steel companies purchased Georgia merchant brown ore during the year, expanded output of the captive iron mines brought about a reduction of such purchases and enabled buyers to be more exacting in specifications.

Michigan and Minnesota.—See Review of Lake Superior District.

Missouri.—Iron-ore production in Missouri decreased very slightly from 1942. Chapman & Doane and the Missouri-Cliffs Mining Co. supplied the bulk of the State output from numerous small brown-ore mines in Wayne, Butler, and Perry Counties. Hematite was produced from small operations in Crawford, Franklin, Iron, Phelps, and St. Francois Counties by the Missouri Mining Co., the M. A. Hanna Co., the M. & B. Mining Co., Julian Pickles, and C. O. Peterson. Plans were underway in 1943 for large-scale operations at the Iron Mountain mine, St. Francois County. This mine has produced only a small quantity of hematite since 1930, when annual production totaled 97,012 tons. The mine will be operated by the Ozark Ore Co., a subsidiary of the M. A. Hanna Co.

Nevada.—Production of iron ore was resumed in Nevada in 1943 with six operators producing a total of 7,368 tons of hematite and magnetite. Mines near Battle Mountain, Lovelock, McKay, and Yerington supplied most of the output, which was shipped to California for metallurgical use and for ballast in shipping vessels.

New Jersey.—A total of 1,263,537 tons of crude magnetite was produced from underground mines in New Jersey in 1943, most of which was later concentrated magnetically. None of the concentrates produced in New Jersey are sintered at mine plants. The Scrub

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[8] Bureau of Mines, War Minerals Report 97: February 1943, 44 pp.

Oaks mine, operated by the Alan Wood Steel Co., was again the largest individual producer in the State. Other producers were the Richard mine operated by the Richard Ore Co., the Mount Hope mine operated by the Warren Foundry & Pipe Corporation, and the Washington mine of the Alan Wood Steel Co. Most of the State output in 1943 came from Morris County, except for the relatively small tonnage produced at the Washington mine in Warren County.

The iron-mining industry in New Jersey was adversely affected by a manpower shortage in 1943, as were mines throughout the entire Northeastern district. The concentrator at the Mount Hope mine was damaged by fire in June, causing the annual output of concentrates to fall somewhat below the 1942 figure. A new vertical, four-compartment shaft at this mine was nearly completed at the end of the year. This shaft is the deepest of the New Jersey iron-ore producers and will have a daily capacity of 3,000 tons. The Ringwood mine in Passaic County was being reconditioned preparatory to operation by the Alan Wood Steel Co. on behalf of the Defense Plant Corporation.

New Mexico.—The St. Louis Smelting & Refining Co.'s El Paso iron claim at Hanover, Grant County, supplied most of the State output in 1943. Other producers included the Magnetite Mining Co. and the Lincoln Ore & Metal Co., operating in Lincoln County; the Ancho Mining Co., Bernalillo County; and mines operated near Ancho, Lincoln County, in Socorro County west of Carrizozo, and Roswell, Chaves County.

New York.—Crude magnetite was produced from six mines in the Adirondack district during the year. Except for lump ore, which is used as a charge and finishing ore in open-hearth furnaces, all of the ore was shipped as concentrate or sinter. The Old Bed-Harmony mine at Mineville and the Chateaugay mine at Lyon Mountain, both operated by the Republic Steel Corporation, were again the largest shippers in the State. The bulk of the ore shipped from these two properties was in the form of sinter, with lesser amounts of concentrates and Old Bed lump ore. The Clifton mine also produced lump ore, although most of the ore shipped was sinter. The Benson mine, which came into production during the latter part of the year, shipped a small quantity of concentrate. Construction of a sintering plant at this mine will be completed in 1944. The MacIntyre mine shipped magnetite and ilmenite concentrates during the year. A new crushing plant, magnetic cobbing plant, and Greenwalt-type sintering plant were under construction in 1943. When these are completed the daily production capacity will be 800 tons of ilmenite concentrates and 2,000 tons of magnetite sinter. The 30-mile railroad spur (a Defense Plants Corporation project) from the railhead at North Creek to the mine site was near completion in December; it will enable National Lead to dispense with the present haul by truck.

Republic's new concentrating and sintering plant, Mill No. 7, was completed during the year, as was development work at the Fisher Hill mine. Although a small quantity of crude ore was hoisted from this mine during the development period, the lack of manpower caused it to remain idle after it had been made ready for large-scale production. This labor shortage which was felt by all other mines in the district, kept New York State production considerably below mine capacity, and caused the development of the Croton mines at Brewster, West-chester County, to be deferred. District mining activities have been described in detail by the officials of the various operating companies in the Adirondack Iron Mining Issue of Mining and Metallurgy [9] and by Otte.[10]

Pennsylvania.—The Bureau of Mines cannot reveal iron-ore statistics for Pennsylvania, as virtually all of the production in the State comes from one operation—the Cornwall mine in Lebanon County. In 1943 this mine produced a large quantity of crude magnetite, which was shipped to the concentrator at Lebanon. Usable ore shipped from Lebanon for furnace consumption included both concentrate and sinter. The only other iron-ore output in the State was a small quantity of siderite from the Hazard and Little Gap mine near Palmerton, Carbon County, which was shipped for use by the paint industry.

During the year preparations were started to recondition the old Scotia mine near State College, Center County. The Scotia Mining Co. engaged Butler Bros., iron-mine operators of Minnesota, to operate the property. This open-pit mine is scheduled to produce 400,000 gross tons of brown ore annually using a truck haulage system. A washing and high-density plant was being built to concentrate the ore. Measured ore reserves are adequate for several years of operation at the scheduled rate of production. A property at Boyertown, approved by the War Production Board, was drilled in 1943; however, further development of this project has been deferred because of the manpower shortage.

South Dakota.—A total of 1,678 tons of brown ore has been produced from the Iron Lode claim near Rochford, Pennington County, during the last 2 years. Of this total, 1,098 tons were produced in 1942. This information was received too late to be included with 1942 statistics and is combined with 1943. All of this ore was shipped for making paint.

Tennessee.—Again in 1943 the only output of iron ore in Tennessee was byproduct pyrite sinter produced by the Tennessee Copper Co. at Ducktown. Shipments of sinter in 1943 contained 67.3 percent iron, 0.09 percent manganese, 0.006 percent phosphorus, and 2.0 percent silica.

Texas.—Iron ore was shipped from two mines in Texas during the year—the Linden mine in Cass County and the Moss mine in Llano County—but only the latter was productive in 1943. Both the Sheffield Steel Corporation and the Lone Star Steel Co. were engaged during the year in preparatory work for mining and beneficiating Texas brown ore, with operations scheduled to begin in 1944.

Utah.—A total of 922,959 tons of iron ore was produced in Utah in 1943 to establish a new record. This surpassed the 321,034 tons produced in 1942 by 187 percent. Large-scale mining at the Duncan mine, operated by the Colorado Fuel & Iron Co., and increased output at the Iron Mountain mine, operated by the Columbia Iron Mining Co., accounted for the increase. The only other operation in Utah was the Great Western mine, which produced a relatively small quantity of ore. All of these open-pit mines produced semialtered magnetite from deposits near Cedar City, Iron County. Ore shipped averaged 53.69 percent iron, 1.23 percent manganese, 0.106 percent phosphorus, 7.89 percent silica, and 2.03 percent lime.

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[9] Mining and Metallurgy, vol. 24, No. 443, Nov. 1943.

[10] Otte, Herman F., Expanding Mineral Industry of the Adirondacks: New York State Div. of Commerce, Publication 10, February 1943, pp. 11-51.

Virginia.—Brown ore produced from the American Pigment Corporation mine at Hiwassee, Pulaski County, constituted the only output from Virginia in 1943. All but a few tons of this ore was washed before consumption by the paint industry.

Washington.—A total of 13,446 tons of ore was produced from three mines in Washington during 1943. The Neutral mine, operated by the Magnetic Mining Co., was the largest producer. Other active mines were the Napoleon, and the Fuller Iron claim, operated by the Spokane Portland Cement Co. and Pateros Iron Co., respectively. All of the ore was shipped either for ballast on shipping vessels or for cement.

Wisconsin.—See Review of Lake Superior District.

Wyoming.—The only iron ore produced in Wyoming in 1943 was hematite from the underground Sunrise mine, which is operated by the Colorado Fuel & Iron Corporation. Production in 1943 was 15 percent less than in 1942 because construction of the new shaft interfered with hoisting operations.

Iron ore mined in the United States in 1943, by States and counties

[Exclusive of ore containing 5 percent or more manganese]

State and county	Active mines	Crude ore	Usable ore
Alabama:			
Bibb	1	645,000	129,079
Blount	1	110,000	25,408
Butler	[1] 3	132,200	26,321
Calhoun	[1] 6	140,200	28,285
Cherokee	[1] 8	138,850	26,280
Chilton	1	15,200	3,042
Clay	[1] 1	77,500	15,511
Colbert	1	621,481	86,267
Franklin	[1] 7	1,663,987	346,670
Jefferson	11	7,339,703	7,118,565
Pike	[1] 3	17,350	3,476
Talladega	[1] 5	347,674	55,135
Tuscaloosa	4	992,000	193,346
	[1] 52	12,241,145	8,057,385
Arizona:			
Yuma	2	261	261
Arkansas:			
Hot Spring	1	144	144
California:			
San Bernardino	1	794,440	783,826
Santa Cruz	1		
Shasta	2		
	4	794,440	783,826
Colorado:			
Chaffee	1	200	39
Georgia:			
Bartow	5	948,200	231,462
Floyd	2	4,310	741
Polk	13	835,900	176,239
Walker	3	12,830	5,026
	23	1,801,240	413,468
Michigan:			
Dickenson	3	542,386	542,386
Gogebic	8	4,378,466	4,378,466
Iron	19	4,824,209	4,824,209
Marquette	16	5,680,727	5,680,727
	46	15,425,788	15,425,788
Minnesota:			
Crow Wing	8	2,039,627	1,747,304
Fillmore	1	367,378	220,427
Itasca	[2] 39	24,483,976	15,396,532
St. Louis	66	52,138,649	51,720,644
	114	79,029,630	69,084,907
Missouri:			
Crawford	1	3,724	3,724
Iron	1		
St. Francois	1		
Butler, Wayne, Perry, Phelps, and Franklin	[1] 3	48,975	48,975
	6	52,699	52,699
Nevada:			
Douglas	1	942	942
Lander	1	388	388
Lyon	1	448	448
Ormsby	1	92	92
Pershing	2	5,498	5,498
	6	7,368	7,368
New Jersey:			
Morris	3	1,263,537	520,691
Warren	1		
	4	1,263,537	520,691
New Mexico:			
Barnalillo	2	41,744	41,744
Chaves	1		
Grant	1		
Lincoln	3		
Socorro	1		
	8	41,744	41,744
New York:			
Clinton	1	5,754,463	2,946,267
Essex	3		
St. Lawrence	2		
Pennsylvania:			
Lebanon	1		
Carbon	1	617	617
	8	5,755,080	2,946,884

See footnotes at end of table.

Iron ore mined in the United States in 1943, by States and counties—Continued

State and county	Active mines	Crude ore	Usable ore
South Dakota:			
Pennington	1	1,678	1,678
Texas:			
Llano	1	1,200	1,200
Utah:			
Iron	3	922,959	922,959
Virginia:			
Pulaski	1	9,469	7,883
Washington:			
Okanogan	2	10,875	10,875
Stevens	1	2,571	2,571
	3	13,446	13,446
Wisconsin:			
Iron	2	1,498,749	1,498,749
Wyoming:			
Platte	1	814,208	814,203
	[2] 287	119,674,980	100,595,322

[1] In addition there is an undetermined number of small pits. The output of these pits is included in the tonnage given.
[2] Includes output from 2 plants reprocessing tailings.

EMPLOYMENT AT IRON MINES

Data on employment at iron mines in 1943 are not yet available. However, a slight decrease in employment and man-hours worked is indicated. The average number employed is estimated at 32,500 men, working a total of 75,000,000 man-hours to produce 100,595,322 tons of ore—an average of about 1.3 tons per man-hour and a slight decrease from 1942. It is interesting to note that the output of usable iron ore per man-hour dropped from 0.524 ton in 1916 to 0.490 ton in 1917 (a decrease of 7 percent), whereas output per man-hour dropped from 1.531 tons in 1941 to 1.394 tons in 1942 (a decrease of 9 percent).

The decrease in efficiency since 1941 is due primarily to the large turn-over in employment and the resulting shortage of experienced miners. Other factors that contributed to this lowered efficiency include depreciation of machinery and equipment and the mining of lower-grade crude ore.

Relations between industry and labor at iron mines were comparatively good. Only a few man-hours were lost during the strikes at Michigan iron mines, and the dispute between labor and management over portal-to-portal pay at Alabama mines was settled in orderly fashion.

Employment at iron-ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per man in 1941 by districts and States

[Exclusive of ore containing 5 percent or more manganese

District and State	Employment					Production									
	Average number of men employed	Time employed				Crude ore, gross tons	Usable ore			Average per man (gross tons)					
		Average number of days	Total man-shifts	Man-hours			Gross tons	Iron contained		Crude ore		Usable ore			
				Average per shift	Total			Gross tons	Percent natural	Per shift	Per hour	Per shift	Per hour	Iron contained	
														Per shift	Per hour
Lake Superior:															
Michigan	7,477	276	2,061,853	8.0	16,494,306	14,671,192	14,671,192	7,582,010	51.68	7.116	0.889	7.116	0.889	3.677	0.460
Minnesota	10,303	247	2,546,851	8.0	20,339,871	73,107,874	62,750,907	32,900,413	52.43	28.705	3.594	24.639	3.085	12.918	1.618
Wisconsin	785	261	205,129	8.0	1,641,032	1,436,233	1,436,233	765,795	53.32	7.002	.875	7.002	.875	3.733	.467
	18,565	259	4,813,833	8.0	38,475,209	89,215,299	78,858,332	41,248,218	52.31	18.533	2.319	16.382	2.050	8.569	1.072
Southeastern States:															
Alabama	6,159	262	1,615,508	8.2	13,208,120	10,306,711	7,884,851	2,929,008	37.15	6.380	.780	4.881	.597	1.813	.222
Georgia	264	157	41,558	9.0	373,678	1,130,895	260,667	122,271	46.91	27.222	3.027	6.282	.699	2.947	.328
Mississippi						382	382	200	45.80						
Virginia									53.60						
	6,423	258	1,657,066	8.2	13,581,798	11,437,988	8,145,900	3,051,479	37.46	6.903	.842	4.916	.600	1.841	.225
Northeastern States:															
Connecticut	923	266	245,085	8.0	1,956,610	88	88	40	45.00	5.208	.652	2.650	.332	1.652	.207
New Jersey						1,276,389	649,374	404,868	62.35						
New York	2,106	339	713,385	7.4	5,304,048	4,335,052	3,312,610	1.598,939	66.92	6.077	.817	4.644	.625	2.241	.301
Pennsylvania									39.64						
	3,029	316	958,470	7.6	7,260,658	5,611,529	3,962,072	2,003,847	50.58	5.855	.773	4.134	.546	2.091	.276
Western States:															
California	190	173	32,841	8.0	262,823	53,833	53,531	29,575	55.25	14.278	1.784	13.928	1.740	7.606	.960
Missouri						18,653	18,653	9,680	51.90						
Nevada						215	215	97	45.00						
Oklahoma						208	208	98	47.10						
Utah						355,006	355,006	193,374	54.47						
Washington						10,423	10,423	6,914	66.30						
South Dakota						30,573	19,387	10,039	46.00						
Texas									52.50						
Wyoming	380	259	98,606	8.0	788,848	985,852	985,852	506,333	51.36	9.998	1.250	9.998	1.250	5.135	.642
	570	235	131,447	8.0	1,051,671	1,454,763	1,443,275	756,110	52.39	11.067	1.383	10.980	1.372	5.752	.719
Total	28,587	264	7,560,816	8.0	60,369,336	107,719,579	92,409,579	47,059,654	50.93	14.247	1.784	12.222	1.531	6.224	.780

Employment at iron-ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per man in 1942, by districts and States

[Exclusive of ore containing 5 percent or more manganese]

District and State	Employment					Production									
	Average number of men employed	Time employed				Crude ore, gross tons	Usable ore			Average per man (gross tons)					
		Average number of days	Total man-shifts	Man-hours			Gross tons	Iron contained		Crude ore		Usable ore			
				Average per shift	Total			Gross tons	Percent natural	Per shift	Per hour	Per shift	Per hour	Iron contained	
														Per shift	Per hour
Lake Superior:															
Michigan	8,314	285	2,369,900	8.0	18,958,359	15,624,161	15,624,161	8,074,743	51.68	6.593	0.824	6.593	0.824	3,407	0.426
Minnesota	11,772	265	3,118,980	8.0	25,070,406	86,333,563	73,937,446	38,528,037	52.11	27.680	3.444	23,706	2.949	12.353	1.537
Wisconsin	751	277	207,840	8.0	1,662,723	1,502,587	1,502,587	791,045	52.65	7.230	.904	7.230	.904	3.806	.476
	20,837	273	5,696,720	8.0	45,691,488	103,460,311	91,064,194	47,393,825	52.04	18.161	2,264	15.985	1.993	8.319	1.037
Southeastern States:															
Alabama	6,867	284	1,953,464	8.8	17,268,918	13,936,708	8,850,534	3,254,661	36.77	7.134	.807	4.531	.513	1.666	.188
Georgia	495	251	124,228	8.8	1,091.280	(1)	(1)	(1)	47.28	10.948	1.246	2.485	.283	1.167	.133
Virginia									37.41						
	7,362	282	2,077,692	8.8	18,360,198	(1)	(1)	(1)	37.12	7.362	.833	4.408	.499	1.636	.185
Northeastern States:															
New Jersey	950	291	276,888	8.0	2,215,103	1,334,690	604,051	379,900	62.89	4.820	.603	2.182	.273	1.372	.172
New York	2,828	318	899,605	8.2	7,364.601	4,862,365	2,515,455	1,523,239	65.95	5.405	.660	2.796	.342	1.693	.207
Pennsylvania									55.19						
	3,778	311	1,176,493	8.1	9,579,704	6,197,055	3,119,506	1,903,139	61.01	5.267	.647	2.652	.326	1.618	.199
Western States:															
Arizona	392	205	80,323	8.4	671,221	345	345	200	58.00	7.669	.918	7.261	.869	3.920	.469
California						95,107	95,107	53,549	56.30						
Missouri						60,811	52,839	26,282	49.74						
New Mexico						95,809	95,809	52,546	54.84						
Texas						(1)	(1)	(1)	52.51						
Utah						321,034	321,034	171,721	53.49						
Washington						11,861	11,861	7,274	61.33						
Wyoming	405	282	114,210	8.0	913,680	957,027	957,027	477,461	49,89	8.380	1.047	8.380	1.047	4.181	.522
	797	244	194,533	8.1	1,584,901	(1)	(1)	(1)	51.51	8.086	.992	7.918	.972	4.073	.500
Total	32,774	279	9,145,438	8.2	75,216,291	126,527,159	104,883,184	53,488,887	51.00	13.835	1.682	11.468	1.394	5.849	.711

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[1] Included in grand total.

WORLD PRODUCTION

Because of space limitations and a desire to emphasize countries that are potential sources of iron ore for United States consumption, the following discussions for 1943 are limited to nations of the Western Hemisphere.

World production of iron ore, 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943
North America:						
Canada	5,281	117,583	376,120	468,138	494,691	581,769
Cuba	234,061	166,739	160,339	192,851	132,847	47,113
Mexico	118,251	143,873	110,783	110,134	102,526	137,936
Newfoundland	1,707,180	1,679,625	1,532,990	981,735	1,209,228	545,708
United States	28,903,861	52,562,024	74,878,718	93,892,753	107,219,890	102,872,863
South America:						
Brazil (exports)	359,115	396,938	255,548	420,756	308,921	308,878
Chile [2]	1,608,399	1,626,490	1,749,840	1,702,692	408,587	299,411
Europe:						
Belgium	180,920	177,370	(3)	(3)	(3)	(3)
Bulgaria	16,771	20,115	30,000	(3)	(3)	(3)
Czechoslovakia [4]	693,000	766,000	862,000	978,000	1,040,000	(3)
France	33,137,000	(5)	(3)	(3)	(3)	(3)
Germany [6]	10,938,650	(5)	(3)	(3)	(3)	(3)
Austria	2,600,063	(5)	(3)	(3)	(3)	(3)
Greece	348,613	307,284	(3)	(3)	(3)	(3)
Hungary	369,935	370,000	(3)	(3)	(3)	(3)
Italy	990,043	(5)	(3)	(3)	(3)	(3)
Luxemburg	5,140,632	(5)	(3)	(3)	(3)	(3)
Norway	1,425,297	1,340,408	(3)	(3)	[7] 300,000	(3)
Poland	872,591	(5)	(3)	(3)	(3)	(3)
Portugal	2,519	418	301	287	18	(3)
Rumania	139,185	131,992	(3)	(3)	150,570	(3)
Spain	2,544,945	3,594,294	2,629,609	1,640,687	1,670,370	1,585,776
Sweden	13,928,023	13,787,202	(3)	(3)	(3)	(3)
Switzerland	[6] 133,998	[6] 171,279	200,000	(3)	(3)	(3)
U. S. S. R. [9]	26,529,700	(5)	27,500,000	22,742,110	(3)	(3)
United Kingdom: Great Britain [10]	12,049,531	(5)	18,000,000	(3)	(3)	(3)
Yugoslavia	606,884	666,816	[7] [11] 553,926	[7] [11] 523,000	(3)	(3)
Asia:						
Burma	18,340	26,680	(3)	(3)	(3)	(3)
Chosen	(5)	(5)	(3)	(3)	(3)	(3)
India, British	2,787,711	3,166,087	(3)	(3)	(3)	(3)
Indochina	130,298	136,000	32,861	(3)	(3)	(3)
Japan	(5)	(5)	(3)	(3)	(3)	(3)
Malay States:						
Federated	938	780	972	(3)	(3)	(3)
Unfederated	1,606,289	1,991,173	1,872,903	(3)	(3)	(3)
Philippine Islands (exports)	910,952	1,154,738	1,191,641	[12] 852,080	(3)	(3)
Turkey	71,375	143,277	130,338	59,182	(3)	[13] 72,883
U. S. S. R.	(9)	(9)	(9)	(9)	(3)	(3)
Africa:						
Algeria	3,105,037	[7] 2,750,000	(3)	(3)	(3)	(3)
Belgium Congo	2,650	(5)	6,100	(3)	(3)	(3)
Morocco:						
French	266,100	(5)	(3)	(3)	(3)	(3)
Spanish	1,341,658	[8] 1,038,006	[8] 389,337	(3)	[8] 460,704	[8] 615,306
Northern Rhodesia	208	138	271	271	(3)	(3)
Sierra Leone	875,789	(5)	(3)	[8] 1,046,501	[8] 643,241	[8] [14] 448,214
South-West Africa	23,861	19,500	(3)	(3)	(3)	(3)
Tunisia	822,053	764,731	(3)	(3)	(3)	(3)
Union of South Africa	505,314	490,136	638,757	812,700	726,810	[14] 538,098
Oceania:						
Australia:						
Queensland	5,207	4,003	(3)	(3)	(3)	(3)
South Australia	2,281,404	2,613,036	2,350,484	2,276,345	(3)	(3)
Tasmania	------------	(5)	(3)	(3)	(3)	(3)
New Caledonia	36,279	83,567	176,600	(3)	(3)	(3)
New Zealand	1,238	1,611	1,208	1,569	2,472	(3)
	162,000,000	200,000,000	[7] 212,000,000	[7] 233,000,000	[7] 245,000,000	(3)

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[1] In addition to the countries listed China, Egypt, Eritrea, Finland, French West Africa, Madagascar, nd New South Wales report production of iron ore, but complete data are not available.
[2] Production of Tofo mines. [3] Data not available. [4] Slovakia only. [5] Estimate included in total.
[6] Exclusive of manganiferous iron ore carrying 12 to 30 percent manganese. [7] Estimate. [8] Exports.
[9] U. S. S. R. in Asia included with U. S. S. R. in Europe.
[10] Exclusive of bog ore, which is used mainly for purification of gas. [11] Croatia only.
[12] January to July, inclusive. [13] January to June, inclusive. [14] January to September, inclusive.

Brazil.—The most important iron-ore deposit in Brazil—and one of the largest in the world—is at Itabira, 350 miles by rail from the port of Victoria, in the State of Minas Gerais. The ore is a high-grade hematite, with measured reserves of 173,000,000 metric tons and inferred ore of 1,000,000,000 tons.[11]

During 1943 considerable work was done on a benching operation at Caue Peak, which supplied a small output in 1942 and 1943. Ore-moving equipment consists of two 4-yard electric power shovels, one 1¼-yard Diesel shovel, and twelve 35-ton Diesel trailer trucks. The ore passes through primary (48-inch) and secondary (20-inch) gyratory crushers and is delivered to rail loading bins by means of a 36-inch rubber conveyor belt. Construction of ore-loading facilities at Victoria begun in 1938 by German engineers and contractors was continued in 1943 by Brazilian and American engineers. The tracks and switching yard are completed, and conveyor equipment is now being installed. Before these facilities were completed the ore reaching Victoria was unloaded by hand and loaded on ships with cranes. All of the iron ore shipped from Victoria in 1943 went to the United Kingdom.

Canada.—The Helen mine shipped 450,973 tons of ore from the Michipicoten range in Ontario, Canada, a decrease of 7 percent from 1942. The water-diversion program at the Steep Rock iron mines was in progress during the year; however, production is not expected to begin until late in 1944. Arrangements were completed during the year for the construction of a high-level pocket-type ore-loading dock at Port Arthur, Ontario, for use in connection with shipments of ore from Steep Rock. During the year prospecting was conducted in the Gunflint district and at the Josephine, Ruth, and Lucy mines.

Chile.—The important iron-ore operation in Chile is the Tofo mine near La Serena, Province of Coquimbo. Production from this mine in 1943 totaled 294,684 gross tons. Of this, 34,968 tons were shipped to blast furnaces at Corral near Valdivia, and the remainder was stockpiled. Stocks at the mine amounted to 290,940 tons at the end of the year. The ore deposit at Tofo is a capping of magnetite, largely altered to hematite and martite, which forms an irregular blanket on top of two small hills made up of diorite. The original north and south hills have now been leveled, and the present workings consist of a series of long benches forming an amphitheater opening to the east along the major axis of the ore body. The lowest level near the bottom of the deposit is 1,930 feet above sea level.

Cuba.—In 1943, 46,369 gross tons of iron ore were produced from the Daiquiri open-cut mine in Oriente Province; all was stock piled. For the 10-year period ended in 1941 annual shipments of iron ore from Cuba averaged 243,086 tons. This was reduced to 18,043 tons in 1942, when war shipping limitations prevented further movement of iron ore from Cuban ports. Stocks totaled 263,345 tons at the end of 1943 compared with 216,976 tons in 1942.

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[11] Malozemoff, A., The United Nations Newest Source of Iron: Eng. and Min. Jour., vol. 144, No. 1, January 1943, pp. 56–59.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1943, in gross tons

Year	Juragua, Daiquirí, and Estancia (hematite and magnetite)	Sigua (hematite)	Mayarí (brown ore)	Guama (hematite)	El Cuero (hematite)	Total
1884–1941	22,496,872	20,438	3,976,853	41,241	903,103	27,438,507
1942	6,202	----------	11,841	----------	----------	18,043
1943	----------	----------	----------	----------	----------	----------
	22,503,074	20,438	3,988,694	41,241	903,103	27,456,550

Labrador.—Six iron-ore deposits in Labrador were discovered during the period 1936–39 by the Labrador Mining & Exploration Co. of Montreal. The principal deposits are at Sawyer Lake, about 280 miles north of Seven Islands in the Gulf of the St. Lawrence. The company estimated that the deposits contained 2,200,000 tons of hematite ore (averaging 65 percent iron) per 100 feet of depth. The phosphorus content is under 0.04 percent. Four deposits of good-grade ore are estimated to contain 70,000,000 tons to a depth of 1,000 feet. Of the two remaining deposits, one is high in manganese and the other high in silica. Field work by the Hollinger Consolidated Gold Mines, Ltd., in 1942 has confirmed these earlier estimates. Exploitation of the deposits would require the construction of a railroad from the site of the deposits to the St. Lawrence River at Seven Islands, a port open to navigation throughout the year. Additional deposits have been discovered since 1939, but estimates of reserves for these deposits are not yet available.

Mexico.—Mexico has important deposits of iron ore in the States of Lower California, Coahuila, Durango, Guerrero, Michoacán, and Oaxaca. The largest deposits in Mexico are those of Cerro del Mercado, Las Truchas, and El Mamey, situated near the West coast, which have been estimated to contain 300,000,000 tons of high-grade hematite, amenable to open-pit mining.

Newfoundland.—The Dominion Steel & Coal, Ltd., Sydney, N. S., announced the temporary closing of its Wabana iron-ore mines on February 25, 1943, owing to shipping shortages that made continued operation impractical. At the start of 1943, operations were cut to 3 days per week, dropping production from 5,700 tons per week to 2,400. Operations were resumed on a 4-day-a-week basis in the middle of May, in spite of an acute manpower shortage. The stock pile of 570,000 tons on hand at closing was reduced to 300,000 in December by continued shipments to blast furnaces at Sydney.

Venezuela.—The Iron Mines Co. of Venezuela, a subsidiary of the Bethlehem Steel Co., is developing a high-grade hematite deposit at El Pao near Upata in the State of Bolívar and continued its preparatory program in 1943, including the completion of roads, ore-loading plant, and the railway to the port of Palua on the Orinoco River, 1½ miles from the town of San Felix. Although difficulties have been encountered in obtaining supplies and equipment during the war, work is continuing, with a view toward commencing operations in 1945.

PIG IRON, FERRO-ALLOYS, AND STEEL

By Norwood B. Melcher and Edward J. Langey[1]

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GENERAL FEATURES IN 1943

The steel industry, in supplying record demands for armament, experienced the most productive year in its history. Output of steel ingots and castings during 1943 totaled 88,836,512 net tons compared with 86,031,931 in 1942. New records were also established in the pig-iron and ferro-alloys industries as 60,765,195 and 2,032,979 tons, respectively, were produced. Steel capacity at the end of the year was 90,636,000 tons, to be increased to 95,948,000 on completion of the expansion program. Blast-furnace capacity was 64,305,000 tons at the end of December, and additional plants will raise this total to 70,441,000 when expansion is completed.

Shipbuilding continued to require more finished steel than any other single consuming industry and used 22,000,000 tons (one-third of production). Miscellaneous industries and exports, largely arms production and Lend-Lease shipments, together received the largest share of the year's steel output, as in 1942. A substantial decrease in the consumption of finished steel was apparent in the construction industry in 1943 as war-plant expansion was nearly completed. Steel for use in civilian products was curtailed as a result of diversion from railroad, agricultural, and household equipment. Pressure for an increased quantity of steel for civilian use caused a study of civilian steel requirements to be started late in the year by Government and industry, but it did not seem likely that there would be any large-scale diversion of steel into this channel for some time, since plants equipped to manufacture most civilian goods were engaged in war production.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

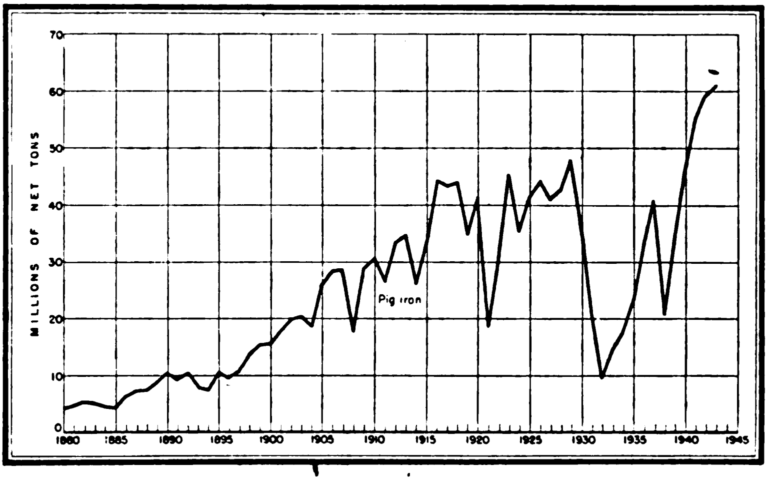

FIGURE 1.—Trend in production of pig iron in the United States, 1880–1943.

In 1943 the steel industry operated under the flexible Controlled Materials Plan, which was started during the first quarter. Under this plan it was able to improvise and to meet changing requirements with an efficiency that could not have been achieved under the old system of rigid priority controls.

Salient statistics of pig iron, ferro-alloys, and steel in the United States, 1942–43

	1942		1943	
	Net tons	Value	Net tons	Value
Pig iron:				
Production	59,077,593	(1)	60,765,195	(1)
Shipments	59,100,601	$1,227,389,689	60,787,159	$1,273,634,210
Average value per ton at furnace		20.77		20.95
Imports			1,610	44,408
Exports	110,647	3,144,701	144,269	4,291,281
Ferro-alloys:				
Production	[2] 1,898,260	(1)	2,032,979	(1)
Shipments:				
Ferromanganese	659,219	82,726,298	722,658	93,481,580
Spiegeleisen	186,163	5,931,728	150,136	4,827,954
Ferrosilicon	707,522	39,691,636	806,198	46,619,979
Other ferro-alloys	[2] 316,307	[2] 130,734,431	316,179	126,558,096
	[2] 1,869,211	[2] 259,084,093	1,995,171	271,487,609
Imports:				
Ferromanganese	14,772	1,274,749	2,302	160,600
Spiegeleisen	1,990	95,853	3,254	140,247
Ferrosilicon	15,325	569,134	10,546	156,077
Steel:				
Production:				
Open-hearth:				
Basic	75,183,065	(1)	77,207,870	(1)
Acid	1,318,892		1,413,934	
Bessemer	5,553,424		5,625,492	
Crucible	2,010		146	
Electric	3,974,540		4,589,070	
	86,031,931	(1)	88,836,512	(1)
Shipments to consuming industry	[2] 60,464,774	(1)	59,905,646	(1)

[1] Data not available.

[2] Revised.

The problem of achieving the highest possible utilization of the Nation's manpower in war and essential civilian production was the most difficult one facing industry in 1943. Its critical nature was emphasized by the President in his message to Congress recommending a national service law. The redistribution of the Nation's manpower by means of shifts from civilian to war industries that characterized 1942 continued through 1943. These shifts are reflected in rates of employment turn-over. The average annual separation rate in manufacturing industries in the 5 years before Pearl Harbor ranged from 3.1 to 4.4 per 100 employees per month. This rate had increased in 1942 to 6.47 and is estimated at 7.22 for 1943. The character of the separations has also changed under the influence of wartime conditions. Voluntary quits, which averaged 1.97 per month per 100 employees in 1941, rose to 3.76 in 1942 and to 5.17 in 1943. Lay-offs per month per 100 employees averaged 2.82 during the 1930's and declined to 0.59 in 1943. The Bureau of Labor Statistics estimates that the time lost in 1943 by reason of strikes was 0.14 percent of the total man-hours in manufacturing industries. This compares with 0.05 percent in 1942 and 0.32 percent in 1941. The greatest loss to the 1943 production effort followed the year's three major strikes in the coal-mining industry, which accounted for one-third of the man-days of idleness during the year. If coal strikes are excluded, however, the man-days lost as a result of strikes still doubled the 1942 record. Concerning the effect of coal strikes on the iron and steel industry, the American Iron and Steel Institute reported a drop in pig-iron production from 5,123,703 tons in May to 4,786,944 in June, and steel production decreased from 7,543,127 tons to 7,010,334. Production of steel in the Pittsburgh-Youngstown district decreased from 99.0 percent of rated capacity in May to 91.0 percent in June, that in the Cleveland-Detroit district decreased from 104.5 percent to 99.5, and that in the Birmingham district from 95.5 percent to 88.0. A walk-out of 170,000 steel workers, chiefly in the Cleveland, Pittsburgh, and Youngstown districts, for 4 days beginning on Christmas caused an estimated loss of 125,000 tons of steel ingots.

The total wage earners in the iron and steel industry decreased from 522,000 in January to 508,000 in November. In complying with the 48-hour workweek recommended by the War Manpower Commission the average number of hours worked per week rose steadily from 41.9 in January to 45.6 in November. The average weekly earnings increased during this period from $46.16 to $51.74.

Late in the year the C. I. O.–United Steel Workers of America presented wage proposals including, among a list of 22 demands, a 17-cent hourly increase over the basic steel wage of 78 cents. Spokesmen for the steel companies maintained that the union's pay proposals would adversely affect the stabilization program and that any approved retroactive pay increases would necessitate substantial increases in the ceilings of steel prices.

POST-WAR OUTLOOK

Because of the accumulated unsatisfied demand for civilian consumer goods created during the war and an inevitable post-war reconstruction program, steel production is not likely to revert quickly to pre-war levels. However, unless retooling and reconversion for civilian production are permitted to get under way before hostilities close, a temporary drop in steel output may be expected during the reconversion period.

Production of steel for the 5-year period following World War I (1919–23) averaged 39,588,147 tons annually, an 11-percent increase over the 5-year (1912–16) period preceding the war, when annual production averaged 36,061,743 tons. If steel production in the post-war period continues at the wartime rate, this percentage increase will be far surpassed. However, if the industry were to operate at 62 percent of capacity, as it did following the last war (1919–23), annual steel production will average 60,000,000 tons, and pig-iron requirements (for both iron and steel furnaces) will total 40,000,000 tons yearly.

The demand for civilian products, which has accumulated in every steel market, will be met as soon as the task of reconversion is completed. The automotive industry, largest peacetime market for steel, will resume its former position. Automotive planners have estimated that a full year of production will be required to bring the Nation's car and truck total up to the 1941 level of 34,000,000 vehicles, and subsequent production will average 6,500,000 cars a year. The railroads, after carrying record-breaking volumes of freight and passenger traffic, will require large quantities of finished steel to replace worn-out rolling stock and rails, despite allocation of 4,260,000 tons to them in 1943.

When peace returns the construction industry will turn from war-plant expansion and shipbuilding to consumers' industries and public works projects. Preliminary surveys indicate a demand for about 1,000,000 tons of steel for highway bridges, in addition to steel required for grade crossings, docks and piers, schools, hospitals, and prefabricated parts for houses.

American producers are anticipating large exports of steel to meet rehabilitation requirements in war-devastated countries. Germany, formerly an important exporter, will find difficulty in competing in the world market, as virtually all of its steel capacity will be needed for reconstruction at home and probably will be called upon to restore devastated areas in other countries. Russia will need a considerable amount of American steel, at least for a few years, as will China. Australia, Brazil, Canada, Chile, India, Mexico, and South Africa have added to their own production facilities and are expected to import less steel.

Annual consumption of steel by the petroleum industry (largely as drill pipe, line pipe, and casing) has been estimated at 2,400,000 tons in the post-war period. Normal and replacement demand for steel by gas, water, and other utilities will consume additional tonnages.

Household appliances will provide a larger market after the war. Production of refrigerators, washing machines, ranges, irons, mixers, cooking utensils, and other household equipment have been curtailed perhaps more than any other commodities. The accumulated demand is far above the normal requirement, and when such goods are again made available steel consumption in these industries will be high.

It is expected that advancements in production technique will create a market in industrial machinery, as antiquated machines and equipment will be replaced by newer, more efficient types. Replacement of farm machinery and a general increase in agricultural mechanization will require additional quantities of steel.

The aircraft industry is expected to provide a post-war market for special alloy steels; however, the total quantity consumed will not affect steel output to a great extent, despite increased airplane production.

The container industry is expected to continue its position as a principal consumer; substitutes used in the war emergency, principally glass, paper, and various fibers, will largely give way to tin plate.

Shipbuilding, now the leading consumer of steel, will revert to its former position as a minor consumer after the war.

The pattern that ferro-alloys will follow after the war is uncertain. The future of this highly specialized industry will depend largely on technical developments. The increased use of alloying metals in the form of ores may reduce ferro-alloy requirements.

PIG IRON

PRODUCTION AND SHIPMENTS

Domestic production of pig iron, exclusive of ferro-alloys, increased 3 percent over 1942 in 1943 and established a new record. The output in 1943 comprised 60,692,620 net tons using coke and 72,575 using charcoal as fuel. Pennsylvania was the largest producer of pig iron in 1943, with 31 percent of the total; Ohio ranked second, with 23 percent.

Pig iron produced and shipped in the United States, 1942–43, by States

State	Produced		Shipped from furnaces			
	1942	1943	1942		1943	
	Net tons	Net tons	Net tons	Value	Net tons	Value
Alabama	4,081,710	3,779,860	4,083,330	$70,638,989	3,811,987	$66,151,938
California	-----	(1)	-----	-----	(1)	(1)
Colorado	(2)	(1)	(2)	(2)	(1)	(1)
Illinois	5,850,070	5,950,430	5,871,858	125,662,134	5,920,894	126,910,295
Indiana	6,430,820	6,713,101	6,446,750	142,920,764	6,722,095	150,497,458
Iowa	-----	-----	(2)	(2)	-----	-----
Kentucky	457,124	706,253	457,124	(2)	706,253	(2)
Maryland	2,490,571	2,525,636	2,493,946	(2)	2,526,748	(2)
Massachusetts	(2)	(2)	(2)	(2)	(2)	(2)
Michigan	1,683,414	1,480,226	1,675,143	25,718,214	1,492,942	24,782,464
Minnesota	373,492	532,354	373,595	(2)	532,761	(2)
New York	4,040,756	3,947,018	4,011,238	78,734,591	3,953,462	79,873,775
Ohio	13,140,362	13,724,885	13,153,014	284,600,670	13,750,856	299,483,340
Pennsylvania	18,064,888	18,571,286	18,038,237	388,006,953	18,593,220	399,568,279
Tennessee	(2)	(2)	(2)	(2)	(2)	(2)
Utah	(2)	(1)	(2)	(2)	(1)	(1)
Virginia	-----	(2)	(2)	(2)	-----	-----
West Virginia	1,408,993	1,331,777	1,417,225	(2)	1,335,331	(2)
Western States [3]	(2)	1,265,364	(2)	(2)	1,218,535	22,649,456
Undistributed [4]	1,055,393	237,005	1,079,141	111,107,374	222,075	103,717,205
	59,077,593	60,765,195	59,100,601	1,227,389,689	60,787,159	1,273,634,210

[1] Included under "Western States."
[2] Included under "Undistributed."
[3] Includes statistics for State entered as "(1)."
[4] Includes statistics for State entered as "(2)."

Shipments of pig iron, exclusive of ferro-alloys, increased 3 percent in quantity and 4 percent in value in 1943 over 1942. The values given represent the approximate amounts received for the iron f. o. b. furnaces and do not include freight costs, selling commissions. and other items figured in some of the market prices for pig iron published by trade journals.

Pig iron shipped from blast furnaces in the United States, 1942–43, by grades

Grade	1942			1943		
	Net tons	Value		Net tons	Value	
		Total	Average		Total	Average
Charcoal	104, 813	$2, 860, 086	$27. 29	72, 943	$2, 215, 491	$30. 37
Foundry	2, 656, 089	53, 221, 988	20. 04	2, 257, 323	45, 774, 819	20. 28
Basic	44, 317, 871	900. 681, 890	20. 32	45, 493, 932	933, 281, 695	20. 51
Bessemer	8, 892, 477	197, 565, 272	22. 22	10, 005, 722	222, 395, 136	22. 23
Low-Phosphorus	520, 642	13, 998, 587	26. 89	575, 473	15, 363, 819	26. 70
Malleable	2, 455, 295	55, 642, 522	22. 66	2, 126, 771	48, 994, 793	23. 04
All other (not ferro-alloys)	153, 414	3, 419, 344	22. 29	254, 995	5, 608, 957	22. 00
	59, 100, 601	1, 227, 389, 689	20. 77	60, 787, 159	1, 273, 634, 210	20. 95

The number of furnaces in blast June 30 and December 31 and the total number of furnaces recorded for 1942 and 1943 were as follows:

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1942–43 [1]

State	In blast June 30, 1942	December 31, 1942			In blast June 30 1943	December 31, 1943		
		In	Out	Total		In	Out	Total
Alabama	20	21		21	20	20	1	21
California		1		1	1	1		1
Colorado	3	3	1	4	3	3	1	4
Illinois	20	19	2	21	21	21		21
Indiana	19	19		[2] 19	18	20		20
Kentucky	2	3		3	3	3		3
Maryland	7	7		7	7	7		7
Massachusetts	1	1		1	1	1		1
Michigan	8	7	1	8	6	6		6
Minnesota	2	2	1	3	3	3		3
New York	16	16	1	17	16	17		17
Ohio	46	48	1	49	46	48	2	50
Pennsylvania	71	73	3	76	66	70	8	78
Tennessee	5	4	1	5	4	3	1	4
Texas							1	1
Utah	1	1	[2] 1	[2] 2	1	2	3	5
Virginia	1	1		1	1	1		1
West Virginia	4	4		4	3	4		4
	226	230	12	242	220	230	17	247

[1] American Iron and Steel Institute.

[2] Revised figure.

CONSUMPTION OF METALLIFEROUS RAW MATERIALS

The production of pig iron in 1943 required 109,801,584 tons of iron ore, sinter, and manganiferous iron ore, 3,337,369 tons of mill cinder and roll scale, 3,392,178 tons of open-hearth and Bessemer slag, 2,150,170 tons of purchased scrap, 297,128 tons of pyrite cinder, and 190,086 tons of miscellaneous material, an average of 1.961 tons of metalliferous materials (exclusive of home scrap and flue dust) per ton of pig iron made.

Of the pig iron manufactured in 1943, it is calculated that 89,334 tons valued at $1,023,928 were made from 161,402 tons of foreign ores, including ore from Africa, Canada, Cuba, Mexico, Newfoundland, Spain, and Sweden, indicating an average yield of 55.35 percent from imported ore. Domestic ore and sinter (109,640,182 tons) and other materials (9,366,931 tons) totaling 119,007,113 tons were reported as used in the manufacture of 60,675,861 tons of pig iron, indicating an average pig-iron yield of 50.99 percent from domestic materials. In addition, 1,417,778 tons of home scrap and 148,944 tons of flue dust were consumed in making pig iron in 1943.

Iron ore and other metallic materials consumed and pig iron produced in 1943 by States, in net tons

	Metalliferous materials consumed					Pig iron produced	Materials consumed per ton of pig iron made			
	Iron and manganiferous iron ores		Sinter	Miscellaneous[1]	Total		Ores	Sinter	Miscellaneous	Total
	Domestic	Foreign								
Alabama	7,631,359	9,509	1,799,179	121,731	9,561,778	3,779,860	2.021	0.476	0.032	2.529
California	1,898,351	11,512	473,282	38,782	2,421,927	1,265,364	1.509	.374	.031	1.914
Colorado										
Utah										
Illinois	10,198,552	....	723,436	664,142	11,586,130	5,950,430	1.714	.121	.112	1.947
Indiana	11,699,413	....	933,619	1,050,334	13,683,366	6,713,101	1.743	.139	.156	2.038
Kentucky	1,224,150	....	22,432	122,361	1,368,943	706,253	1.733	.032	.173	1.938
Maryland	3,559,983	14,342	324,471	893,146	4,791,942	2,525,636	1.415	.128	.354	1.897
Michigan	2,477,034	....	306,619	91,452	2,875,105	1,480,226	1.673	.207	.062	1.942
Minnesota	1,027,432	....	13,545	58,665	1,099,642	532,354	1.930	.025	.110	2.065
New York	6,601,782	80,274	783,855	381,159	7,847,070	3,947,018	1.693	.198	.097	1.988
Ohio	20,119,170	....	3,838,961	2,242,771	26,200,902	13,724,885	1.466	.280	.163	1.909
Pennsylvania	27,592,123	23,816	3,646,774	3,566,522	34,829,235	18,571,286	1.487	.196	.192	1.875
Massachusetts	317,485	21,949	46,942	35,629	422,005	237,005	1.432	.198	.151	1.781
Tennessee										
Virginia										
West Virginia	2,311,335	....	68,898	100,237	2,480,470	1,331,777	1.736	.052	.075	1.863
	96,658,169	161,402	12,982,013	9,366,931	119,168,515	60,765,195	1.593	.214	.154	1.961

[1] Excludes recycled materials.

The iron ore used in Alabama (all domestic) in 1943 was mainly hematite from mines in Jefferson County. However, brown ore and small quantities of hematite from other districts in Alabama and Georgia were also used. In addition, ferruginous manganese ore of both domestic and Cuban origin amounting to 9,454 and 9,509 tons, respectively, were used. Because the average grade of ores used in Alabama is low, furnaces in this State use more ore per ton of pig iron than any other district in the United States.

The iron ore used in the Fontana (Calif.) furnace was hematite supplied by the Vulcan mine in San Bernardino County, Calif. Manganese-bearing ore of both domestic and Mexican origin was also used.

Maryland furnaces consumed chiefly domestic ore in 1943, but some iron ore from Africa and pyrite cinder of both domestic and foreign origin were used. These furnaces had a low consumption of ore per ton of pig; however, they used proportionately more miscellaneous materials than any other State.

Blast furnaces in Illinois, Indiana, Kentucky, Michigan, Minnesota, and West Virginia used Lake Superior iron ore and manganiferous iron ore almost exclusively.

In New York the furances in the Buffalo district used ore from the Lake Superior district and Canada, magnetite from New York, and some manganese ore from Cuba, and the furnace at Troy consumed magnetite sinter from the Chateaugay mine at Lyon Mountain, N. Y.

Foreign iron and manganiferous iron ore consumed in the manufacture of pig iron in the United States, 1942–43, by sources of ore, in net tons

Source	1942	1943	Source	1942	1943
Africa	4,871	36,034	Mexico		11,512
Australia	790		Newfoundland	24,180	23,035
Brazil	9,173		Spain	2,721	336
Canada	114,906	78,745	Sweden	990	702
Chile	662,420		Source not stated	1,932	
Cuba	77,368	11,038			
India	1,573			900,924	161,402

Ohio blast furnaces consumed magnetite sinter from New York in addition to hematite from the Lake Superior district.

Virtually all the ore consumed in western Pennsylvania furnaces came from the Lake Superior district. Those in the eastern part of the State used some Lake ore; magnetite ores from Pennsylvania, New Jersey, and New York; and some ore from Africa, Newfoundland, Spain, and Sweden.

The Colorado furnaces used hematite from the Sunrise mine in Wyoming, semialtered magnetite from the Duncan mine (Utah), and magnetite and manganese-bearing ores from New Mexico.

The Provo (Utah) furnace used semialtered magnetite from the Iron Mountain mine near Cedar City, Utah, and manganese-bearing ores, chiefly from Nevada. The sinter used was produced at Provo.

VALUE AT BLAST FURNACES

The average value of all grades of pig iron given in the following table is based upon reports of producers to the Bureau of Mines. The figures represent the approximate values f. o. b. blast furnaces and do not include the values of ferro-alloys. The general average value for all grades of pig iron at the furnaces was $20.95 a net ton in 1943, $0.18 more than in 1942.

Average value per net ton of pig iron at blast furnaces in the United States, 1939–43, by States

State	1939	1940	1941	1942	1943
Alabama	$14.42	$14.30	$17.25	$17.30	$17.35
Illinois	18.02	18.05	20.79	21.40	21.43
Indiana	18.03	18.26	21.22	22.17	22.39
Michigan	14.79	13.78	15.72	15.35	16.60
New York	18.29	16.89	17.91	19.63	20.20
Ohio	18.12	18.81	20.67	21.64	21.78
Pennsylvania	18.52	19.40	21.07	21.51	21.49
Western States	(1)	(1)	(1)	(1)	[2] 18.59
Other States [3]	14.91	15.20	18.62	19.09	[4] 19.48
Average for United States	17.44	17.90	20.13	20.77	20.95

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[1] Colorado and Utah included with other States.

[2] California, Colorado, and Utah.

[3] Includes States entered as "(1)" and Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Tennessee, Virginia, and West Virginia.

[4] Excludes Iowa.

COMMERCIAL QUOTATIONS

The average monthly prices of Foundry, Basic, and Bessemer pig iron at Valley furnaces and of Foundry pig iron at Birmingham furnaces, according to published market quotations, are summarized in the following tables:

Average monthly prices per net ton of chief grades of pig iron, 1942–43 [1]

Month	Foundry pig iron at Valley furnaces		Foundry pig iron at Birmingham furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1942	1943	1942	1943	1942	1943	1942	1943
January	$21.43	$21.43	$18.20	$18.20	$21.88	$21.88	$20.98	$20.98
February	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
March	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
April	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
May	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
June	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
July	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
August	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
September	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
October	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
November	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
December	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98
Average	21.43	21.43	18.20	18.20	21.88	21.88	20.98	20.98

[1] Metal statistics, 1944.

FOREIGN TRADE

Pig iron imported for consumption in the United States, 1939–43, by countries, in net tons [1]

Country	1939	1940	1941	1943
North America: Canada	7,685	3,826	308	49
South America: Brazil	174			
Europe:				
Denmark	1			
Netherlands	7,250			
Sweden	292			
United Kingdom [2]				560
Asia: India and Dependencies	27,821	7,645		500
Africa: Morocco, French				165
Oceania: Australia			3,367	336
	43,223	11,471	3,675	1,610
Value	$663,091	$189,379	$61,130	$44,408

[1] None imported in 1942.

[2] United Kingdom of Great Britain and Northern Ireland.

Pig iron exported from the United States, 1942–43, by countries, in net tons

Country	1942	1943	Country	1942	1943
North America:			Europe—Continued.		
Canada	1,691	7,604	United Kingdom [1]	105,495	121,317
Cuba	84	55	Other Europe		112
Iceland	16	231	Asia:		
Jamaica		141	India and Dependencies		57
Panama	127		Netherlands Indies	168	
Other North America	47	136	Africa:		
South America:			Algeria		1,539
Argentina	336	431	Belgian Congo	263	395
Bolivia	235	100	French West Africa		326
Chile	578	1,228	Morocco, French		418
Colombia		150	Other Africa	59	14
Peru		870	Oceania: New Zealand	1,118	
Uruguay		1,202		110,647	144,269
Other South America		45	Value	$3,144,701	$4,291,281
Europe:					
Portugal		4,171			
U. S. S. R.	430	3,727			

[1] United Kingdom of Great Britain and Northern Ireland.

CONSUMPTION

Consumption of pig iron rose 2 percent in 1943 over 1942. Pig iron, a product of the blast furnace, is a semi-raw material and, except for the small quantity used in direct castings, moves to steel- or iron-melting furnaces for further refining or mixture with other required ingredients. In 1943, 89 percent of the pig iron went to steel-making furnaces (open-hearth, bessemer, and electric) to be processed into steel. Direct castings took 4 percent of the 1943 total, and the remaining 7 percent was consumed in iron-making furnaces, of which the cupola is the most important. The consumption of pig iron, by types of furnace, for 1940 to 1943 is shown in the following table. The quantities of pig iron used in these furnaces are supplemented by the addition of ferrous scrap. The proportion of pig iron to scrap used in steel furnaces increased in 1943 over 1942.

Consumption of pig iron in the United States, 1940–43, by type of furnace

Type of furnace or equipment	1940		1941		1942		1943	
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total
Open-hearth	36,297,250	78.6	42,481,404	75.6	45,538,846	77.1	47,107,608	78.1
Bessemer	3,828,978	8.3	5,993,264	10.7	6,131,222	10.4	6,257,927	10.4
Electric	46,506	.1	72,758	.1	92,878	.2	393,819	.6
Cupola [1]	4,106,119	8.9	5,388,747	9.6	4,490,532	7.6	3,602,918	6.0
Air Brackelsberg	374,187	.8	604,835	1.1	555,436	.9	537,902	.9
Crucible	184	(2)	207	(2)	221	(2)	457	(2)
Puddling	28,293	.1	54,183	.1	49,835	.1	38,231	.1
Direct castings [1]	1,504,311	3.2	1,590,074	2.8	2,183,913	3.7	2,376,297	3.9
	46,185,828	100.0	56,185,472	100.0	59,042,883	100.0	60,315,159	100.0

[1] Some pig iron used in making direct castings included in cupola.
[2] Less than 0.05 percent.

Plants using pig iron are situated in all 48 States, the District of Columbia, and Alaska. As expected from the uses of pig iron, consumption is concentrated largely in the iron- and steel- making centers of the North Central, Middle Atlantic, and Southeastern States. These areas in 1943 used about 97 percent of the pig iron, Pennsylvania (the leading consumer) taking about 32 percent of the total and Ohio (the second-largest consumer) 21 percent.

Consumption of pig iron in the United States, 1940-43, by States and districts

State and district	1940		1941		1942		1943	
	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons
Connecticut	60	96,574	62	143,862	61	138,938	56	113,588
Maine	15	8,392	14	11,467	13	8,763	14	6,133
New Hampshire	14	2,479	15	5,816	16	20,523	15	5,830
Massachusetts	104	146,886	107	242,265	101	244,993	103	225,465
Rhode Island	11	37,308	12	57,082	12	58,116	12	46,756
Vermont	12	10,358	14	16,276	12	20,653	13	14,751
Total New England	216	301,997	224	476,768	215	491,986	213	412,523
Delaware	7	362,758	7	449,486	7	532,783	7	415,936
New Jersey	81		80		84		77	
New York	190	2,403,248	199	2,765,216	200	3,015,417	198	3,032,096
Pennsylvania	348	14,634,036	391	17,573,102	392	18,843,804	375	19,367,283
Total Middle Atlantic	626	17,400,042	677	20,787,804	683	22,392,004	657	22,815,315
Alabama	59	2,809,064	74	3,142,958	71	3,408,958	68	3,101,043
District of Columbia	1	2,825,324	1	2,974,834	1	3,055,553	1	3,156,432
Kentucky	24		23		23		23	
Maryland	25		26		28		21	
West Virginia	23	1,016,445	28	1,218,175	27	1,624,014	28	1,748,020
Florida	13	73,045	12	83,895	15	81,229	18	88,719
Georgia	40		43		44		45	
Mississippi	9	365	7	621	6	615	6	576
North Carolina	33	15,901	40	18,591	42	16,076	42	13,464
South Carolina	14	2,355	12	5,090	14	4,532	15	4,610
Tennessee	50	162,936	52	254,840	51	165,331	52	184,878
Virginia	44		45		47		51	
Total Southeastern	335	6,905,435	363	7,699,004	369	8,356,308	370	8,247,742
Arkansas	6	2,107	6	2,600	3	3,053	3	4,098
Oklahoma	8		7		7		10	
Louisiana	8		7		6		7	
Texas	23	2,327	27	3,107	28	4,428	40	23,715
Total Southwestern	45	4,434	47	5,707	44	7,481	60	27,813
Illinois	183	3,764,275	208	4,915,372	212	5,369,942	208	5,266,187
Indiana	126	5,522,177	131	6,833,091	127	6,963,040	126	7,218,967
Iowa	52	63,834	52	104,368	54	64,012	51	68,883
Minnesota	51	214,340	53	266,768	57	308,937	59	412,853
Missouri	53	45,486	51	80,065	53	81,677	53	123,124
Kansas	13	3,742	15	4,251	11	5,882	14	6,682
Nebraska	8		10		10		11	
Michigan	173	2,232,069	174	2,478,219	175	2,104,082	172	2,098,447
Wisconsin	115		111		114		112	
North Dakota	-----	-----	-----	-----	-----	-----	1	210
South Dakota	2	106	2	86	2	76	2	
Ohio	285	9,080,242	319	11,676,773	325	11,958,323	324	12,410,067
Total North Central	1,061	20,926,271	1,126	26,358,993	1,140	26,855,971	1,133	27,605,420
Arizona	1	35	2	67	2	36	2	81
Nevada	1							
New Mexico	1							
Colorado	10	457,487	18	644,393	18	666,254	16	721,672
Utah	7							
Idaho	1	687	4	578	5	648	4	468
Wyoming	1							
Montana	3							
Total Rocky Mountain	25	458,209	24	645,038	25	666,938	22	722,221
Oregon	19	7,519	18	9,830	17	17,178	21	35,699
Washington	36		33		30		38	
California	93	181,921	98	202,328	93	255,017	114	448,426
Total Pacific Coast	148	189,440	149	212,158	140	272,195	173	484,125
Total United States	2,456	46,185,828	2,610	56,185,472	2,616	59,042,883	2,628	60,315,159

WORLD PRODUCTION

The following table shows the production of pig iron, by countries, from 1939 to 1943, insofar as statistics are available.

World production of pig iron (including ferro-alloys), 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943
Australia [2]	944,597	1,122,334	(3)	(4)	(4)	(4)
Belgian Congo	[5] 600	[5] 600	[5] 600	(4)	(4)	(4)
Belgium	2,426,130	3,058,730	[6] 2,200,000	(4)	(4)	(4)
Brazil	122,352	160,016	185,570	208,795	[5] 208,000	352,680
Canada	773,573	845,461	1,323,128	1,579,648	1,985,500	1,793,451
China (Manchuria)	[5] 700,000	[5] 700,000	[5] 700,000	[5] 1,380,000	[5] 2,400,000	(4)
Chosen	[5] 200,000	[5] 200,000	[5] 200,000	(4)	(4)	(4)
Czechoslovakia	1,233,987	[7] 1,000,000	(8)	(4)	(4)	(4)
Finland	27,000	[5] 30,000	(3)	(4)	(4)	(4)
France	6,061,322	[7] 7,900,000	[6] 4,600,000	(4)	(4)	(4)
Germany [9] Austria	18,596,000	[7] 20,300,000	[6] 21,000,000	(4)	(4)	(4)
Hungary	350,537	[7] 460,000	(3)	(4)	(4)	(4)
India, British	1,583,284	1,785,242	2,015,116	(4)	(4)	(4)
Italy	928,847	[7] 1,000,000	[6] 890,000	(4)	(4)	(4)
Japan	[5] 2,800,000	[5] 3,000,000	[6] 3,000,000	(4)	(4)	(4)
Luxemburg	1,500,000	[7] 1,800,000	[6] 1,000,000	(4)	(4)	(4)
Mexico	98,376	141,335	93,179	108,524	(4)	(4)
Netherlands	266,956	284,004	(3)	(4)	(4)	(4)
Norway	173,748	190,785	(3)	(4)	(4)	(4)
Poland	967,668	[7] 1,000,000	(8)	(4)	(4)	(4)
Rumania	132,681	[5] 140,000	(3)	(4)	(4)	(4)
Spain	442,574	473,360	588,076	545,148	549,030	(4)
Sweden	713,579	691,402	787,211	(4)	(4)	(4)
Union of South Africa	294,406	300,227	303,923	360,000	362,800	486,800
U. S. S. R	15,179,856	[7] 15,200,000	[6] 15,500,000	[5] 13,100,000	[5] 7,075,000	(4)
United Kingdom	6,871,546	[7] 8,300,000	[6] 8,437,000	(4)	(4)	(4)
United States	19,474,677	32,321,653	43,026,030	51,456,627	55,316,075	56,969,248
Yugoslavia	58,458	61,106	(3)	[10] 75,000	(4)	(4)
	82,923,000	102,466,000	107,882,000	(4)	(4)	(4)

[1] Pig iron is produced in Chile, New Zealand, and the Philippine Islands in addition to countries listed, but production figures are not available.
[2] Year ended June 30.
[3] Estimate included in total.
[4] Data not available.
[5] Estimated production.
[6] Approximate production as published by The Iron Age, vol. 147, No. 1, January 2, 1941, p. 61.
[7] Approximate production as published by Steel, vol. 106, No. 1, January 1940, p. 269.
[8] Included in the German figure in 1940.
[9] Beginning with March 1935, production of the Saar is included with that of Germany.
[10] Croatia only.

Reliable production data have not been available since 1939. An estimate of the 1943 world production, based upon the rate of increase for the years from 1934 to 1940, indicates a figure of 120,000,000 metric tons. Two counteracting forces undoubtedly have operated to throw production off the expected value. The effect of accelerated demand (evident in all commodities) has operated to raise the production of pig iron, while the effect of military attack (largely air) upon industrial centers has operated to offset this increase.

On the whole, the 1943 world production of pig iron may be expected to have reached 120 to 130 million net tons.

FERRO-ALLOYS

PRODUCTION AND SHIPMENTS

The production of ferro-alloys in 1943 totaled 2,032,979 net tons compared with 1,898,260 (revised figure) tons in 1942—an increase of 7 percent. In 1943 ferro-alloys were made at 18 blast-furnace plants, 25 electric-furnace plants, and 3 aluminothermic plants. In addition 2 plants made ferrophosphorus and 2 plants made ferrosilicon as a byproduct. Of the 1943 total, 1,118,066 tons were made in blast furnaces, 883,618 tons in electric furnaces, and 30,013 tons by the aluminothermic process; 1,282 ton of alloys were produced as byproducts. Shipments of all classes of ferro-alloys in 1943 increased 7 percent in quantity and 5 percent in value over 1942.

Ferro-alloys produced and shipped from furnaces in the United States, 1942–43

Alloy	1942			1943		
	Production (net tons)	Shipments		Production (net tons)	Shipments	
		Net tons	Value		Net tons	Value
Ferromanganese	661,338	659,219	$82,726,298	702,484	722,658	$98,481,580
Spiegeleisen	186,026	186,163	5,931,728	149,036	150,136	4,827,954
Ferrosilicon	712,710	707,522	39,691,636	818,351	806,198	46,619,979
Ferrophosphorus	28,161	7,761	513,886	37,762	6,344	404,611
Ferrotungsten	7,108	7,148	21,547,454	7,561	7,403	22,090,310
Ferroboron	190	113	(1)	(2)	(2)	(1)
Ferrotitanium	17,048	16,823	(1)	16,772	16,523	(1)
Ferrovanadium						
Ferromolybdenum	41,718	41,680	(1)	37,727	33,603	(1)
Molybdic oxide						
Calcium molybdate and compounds						
Other varieties [3]	[4] 243,961	[4] 242,782	(1)	263,286	252,306	(1)
	[4] 1,898,260	[4] 1,869,211	[4] 259,084,093	2,032,979	1,995,171	271,487,609

[1] Value included in total.
[2] Included with "Other varieties."
[3] Silicomanganese, manganese briquets, ferrochromium, chrome-manganese, ferrocolumbium, zirconium-ferrosilicon, and alsifer, and ferroboron in 1943.
[4] Revised.

Ferromanganese.—The output of ferromanganese in 1943 came from 11 blast-furnace plants and 2 electric-furnace plants compared with 11 blast-furnace plants and 3 electric plants in 1942. Of the manganese ore used in 1943, 85.6 percent was foreign ore. The ferromanganese produced in 1943 averaged 78.98 percent manganese. During 1943 steel producers used 13.0 pounds of metallic manganese as ferro-alloys, per ton of steel produced. Of this quantity 11.7 pounds were in the form of ferromanganese. A total of 736,288 tons of ferromanganese was consumed in 1943—virtually all by the iron and steel industry.

Spiegeleisen.—The spiegeleisen produced in 1943 came from seven blast-furnace plants, averaged 19 percent manganese, and had an average value of $32.16 per net ton at furnaces. All spiegeleisen in 1943 was manufactured from domestic materials and was made by the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.; the New Jersey Zinc Co., New York, N. Y.; the Sloss-Sheffield Steel & Iron Corporation, Birmingham, Ala.; E. J. Lavino & Co., Philadelphia, Pa.; and the Inland Steel Co., Chicago, Ill.

Ferrosilicon.—Of the total of 818,351 net tons of ferrosilicon produced in 1943, 309,068 tons were produced in blast furnaces, 508,260 tons in electric furnaces, and 1,023 tons as a byproduct in the manufacture of artificial abrasives in electric furnaces. The silicon content of the production in 1943 ranged from 9 to 95 percent and averaged 31 percent. Blast-furnace production averaged about 10 percent silicon.

Ferrophosphorus.—Most of the ferrophosphorus was made in electric furnaces in 1943. However, some was produced as a byproduct in the manufacture of phosphates. The ferrophosphorus produced in 1943 averaged 24 percent phosphorus, and shipments were valued at $63.78 per net ton f. o. b. furnaces. All was made from domestic materials.

Ferrotungsten.—Shipments of ferrotungsten gained 4 percent in quantity and 3 percent in value over 1942. The 1943 shipments contained 78.56 percent (11,632,568 pounds) of tungsten and were valued at $1.899 per pound of contained tungsten. Production totaled 7,561 net tons containing 78.54 percent (11,876,016 pounds) of tungsten. The ferrotungsten in 1943 was made in electric furnaces from both foreign and domestic ores.

Ferrochromium.—The industrial consumers of ferrochromium reported using 183,019 tons of ferrochromium during 1943.

Ferromolybdenum.—The bulk of the ferromolybdenum produced in 1943 was made by the aluminothermic process. All was produced from domestic ores and averaged 63 percent Mo.

Molybdic oxide, calcium molybdate, and molybdenum compounds.—As these products are used as alloying agents in the production of iron and steel, they are included with ferro-alloys. These compounds averaged 53 percent Mo in 1943. These materials are considerably less expensive than ferromolybdenum and consequently are used to a greater extent.

Ferrovanadium.—The ferrovanadium in 1943 was produced by electric and aluminothermic processes, using both foreign and domestic ores.

Silicomanganese.—The silicomanganese produced in 1943 averaged 67 percent manganese and was produced in electric furnaces.

Manganese briquets.—During 1943, manganese briquets averaged 57 percent Mn. This product is used chiefly in the foundry industry.

Ferrotitanium.—The bulk of the ferrotitanium produced in 1943 was made in electric furnaces, but some was produced by the aluminothermic process. Both foreign and domestic ores were consumed in the manufacture of ferrotitanium in 1943. Ferrotitanium is used chiefly as a deoxidizer and scavenger in steel making and is also valuable as an alloying agent in certain steels to prevent intergranular corrosion.

Ferroboron.—The ferroboron produced in 1943 averaged 16 percent B. Boron finds its main use in special steels as a hardening agent.

Ferrocolumbium.—Columbium additions have a valuable use in preventing intergranular corrosion. The production in 1943 averaged 57 percent Cb.

Zirconium-ferrosilicon.—The zirconium-ferrosilicon produced in 1943 averaged 14 percent Zr. Zirconium is a powerful deoxidizer and scavenger and reduces age hardening, thereby improving deep drawing properties of sheet steel.

FOREIGN TRADE

Imports and exports of the rarer metals are not recorded separately but are grouped as shown in the following tables. Ferromanganese and spiegeleisen comprised most of the imports in both 1942 and 1943.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1942–43, by varieties

Variety of alloy	1942			1943		
	Gross weight (net tons)	Content (net tons)	Value	Gross weight (net tons)	Content (net tons)	Value
Ferromanganese:						
Containing over 1 percent carbon	14, 772	11, 635	$1, 274, 749	2, 302	990	$160, 600
Manganese boron, manganese metal, and spiegeleisen not more than 1 percent carbon (manganese content)	(1)	5	2, 220			
Spiegeleisen	1, 990	(1)	95, 853	3, 254	(1)	140, 247
Ferrochrome or ferrochromium:						
Containing 3 percent or more carbon	9	5	1, 598	16	10	2. 986
Containing less than 3 percent carbon	573	377	185, 963	455	305	108, 670
Ferrosilicon	15, 325	4, 337	569, 134	10, 546	901	156, 077
Chromium and zirconium silicon and calcium silicide	30	(1)	10, 144			
Tungsten and combinations, in lumps, grains, or powder: Tungsten metal (tungsten content)	(1)	2	7, 668			

[1] Not recorded.

Ferromanganese and ferrosilicon imported for consumption in the United States, 1942–43, by countries

Country	Ferromanganese (manganese content)				Ferrosilicon (silicon content)			
	1942		1943		1942		1943	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Canada	5, 040	$654, 219			4, 337	$569, 134	901	$156, 077
India and Dependencies			990	$160, 600				
United Kingdom [1]	6, 595	620, 530						
	11, 635	1, 274, 749	990	160, 600	4, 337	569, 134	901	156, 077

[1] United Kingdom of Great Britain and Northern Ireland.

Ferro-alloys and ferro-alloy metals exported from the United States, 1942–43, by varieties

Variety of alloy	1942		1943	
	Net tons	Value	Net tons	Value
Ferromanganese	7, 165	$976. 923	12, 510	$1, 717, 888
Spiegeleisen	58	2, 190	314	10, 123
Other ferro-alloys [1]	14, 637	6, 459, 196	33, 787	5, 513, 018

[1] Includes ferrosilicon, ferrotungsten, ferrovanadium, and other ferro-alloys.

STEEL

GENERAL FEATURES

Steel production continued at a high rate throughout 1943, furnaces operating at an average of 98 percent of capacity for the year. Capacity for producing steel increased 343,000 net tons to reach a new record total of 90,636,000 tons. Total production of steel in the United States in 1943 was 88,836,512 tons, a record output. Of the total, 88.5 percent was made in open-hearth furnaces. 6.3 percent in bessemer converters, 5.2 percent in electric furnaces, and only 146 tons in crucible furnaces. The data concerning steel production used by the Bureau of Mines are furnished by the American Iron and Steel Institute. The output from steel foundries that do not produce steel ingots is not included in the statistics.

Steel capacity, production, and percent of operations, 1939–1943, in net tons [1]

[Ingots and steel for castings [2]]

Year	Capacity	Production					Percent capacity
		Open hearth	Bessemer	Crucible	Electric and all other	Total	
1939	81,828,958	48,409,800	3,358,916	931	1,029,067	52,798,714	64.5
1940	81,619,496	61,573,083	3,708,573	1,024	1,700,006	66,982,686	82.1
1941	[3] 85,158,150	74,389,619	5,578,071	2,313	2,869,256	82,839,259	97.3
1942	[4] 90,293,000	76,501,957	5,553,424	2,010	3,974,540	86,031,931	96.8
1943	[5] 90,636,000	78,621,804	5,625,492	146	4,589,070	88,836,512	98.0

[1] American Iron and Steel Institute.

[2] The figures include only that portion of the capacity and production of steel for castings used by foundries which were operated by companies producing steel ingots.

[3] Average annual capacity as of January 1 and July 1, 1941.

[4] Annual capacity as of January 1, 1943.

[5] Annual capacity as of December 31, 1943.

Monthly output ranged from a low of 6.8 million tons in February to a peak of 7.8 million tons in October, when operations were at 102 percent of capacity. During the first 3 months of the year the operating rate increased progressively from 98 percent to 100 percent of capacity. In the second quarter the operating rate decreased progressively to June, when strikes at coal mines caused a drop to 95 percent of capacity. The operating rate increased steadily from July until October, followed by decreases in November and December. The operating rate of 94 percent of capacity in December was the lowest of the year, because new additional capacity could not be fully utilized owing to the manpower shortage and a strike of steel workers.

In 1943, 92.5 percent of the domestic steel output was made in furnaces in the Northeastern district, 4.3 percent was produced in the Southern district, and 3.2 percent was made in the Western district compared with 92.9 percent, 4.3 percent, and 2.8 percent, respectively, in 1942.

Open-hearth steel ingots and castings manufactured in the United States, 1939–43, by States, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

State	1939	1940	1941	1942	1943
New England States	286,850	322,753	462,754	472,521	487,773
New York and New Jersey	2,627,910	3,618,444	4,232,521	4,378,808	4,488,951
Pennsylvania	13,622,272	18,469,170	23,007,147	23,562,866	24,548,335
Ohio	9,913,454	11,769,780	14,746,523	14,769,085	14,834,574
Indiana	6,486,502	8,421,956	10,366,380	10,578,989	10,679,645
Illinois	3,687,874	4,963,457	5,998,679	6,335,946	6,350,309
Other States	11,784,938	14,007,523	15,575,615	16,403,742	17,232,217
	48,409,800	61,573,083	74,389,619	76,501,957	78,621,804

Bessemer-steel ingots and castings manufactured in the United States, 1939–43, by States, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

State	1939	1940	1941	1942	1943
Ohio	1,439,629	1,459,807	2,265,987	2,250,717	2,365,326
Pennsylvania	1,109,081	1,366,017	1,966,779	1,997,547	1,926,316
Other States	810,206	882,749	1,345,305	1,305,160	1,333,850
	3,358,916	3,708,573	5,578,071	5,553,424	5,625,492

Steel electrically manufactured in the United States, 1939–43, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1939	951,522	77,545	1,029,067	1942	3,843,757	130,783	3,974,540
1940	1,608,032	91,974	1,700,006	1943	4,473,377	115,693	4,589,070
1941	2,758,611	110,645	2,869,256				

The steel output for 1943 includes 13,149,818 net tons of alloy-steel ingots and castings, which represents 15 percent of the total. This figure includes steels in which the minimum of the range specified in one or more of the elements named exceeds the following percentages: Copper, 0.60 percent; manganese, 1.65 percent; silicon, 0.60 percent; aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, and zirconium, any percentage. The output of alloy steels in 1943 increased 14 percent and that of total steel 3 percent over 1942. Of the total alloy-steel output in 1943, 65 percent came from basic open hearths, 5 percent from acid open hearths, 30 percent from electric furnaces, 136 tons from crucible furnaces, and none from bessemer converters.

From the accompanying tables it will be seen that most of the steel made in electric furnaces (86 percent in 1943) is alloy steel. Typically, steels with higher alloy content are made in electric furnaces and steel with lower alloy content by the open-hearth process.

Alloy-steel ingots and castings manufactured in the United States, 1939–43, by processes, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

Process	1939	1940	1941	1942	1943
Open hearth, basic	2,302,273	3,421,961	5,306,415	7,524,209	8,539,523
Open hearth, acid	156,581	252,965	433,240	608,867	677,416
Bessemer	3,486	3,990	3,890	----------	----------
Crucible	231	255	933	522	136
Electric	749,384	1,286,716	2,461,651	3,392,776	3,932,743
	3,211,955	4,965,887	8,206,129	11,526,374	13,149,818

CONSUMPTION OF METALLIFEROUS MATERIALS

During 1943 steel furnaces used a total of 6,145,626 net tons of ores (excluding mill scale) and sinter. Of this quantity 74,924 tons were foreign, originating in Africa, Brazil, Mexico, and Sweden.

Both charge ore and feed ore are used in the basic open-hearth process. Charge ore is added for the purpose of furnishing oxygen to the charge before it is melted. This ore should be low in both combined and uncombined moisture, silica content, and fines. Ore containing high quantities of silica requires large additions of limestone and consequently large volumes of slag, which are expensive and reduce furnace efficiency.

Feed ore, which is added to the heat during the working period, should be hard, dense, coarse, and low in moisture. Although rather high silica ore can be used as feed ore it is undesirable, as in charge ore, because of the high volume of slag necessitated. Lump ore, which is preferred as feed ore, commands a high price because it is usually mined by underground methods, and the supply is limited.

Sintered pyrite ash and sintered iron ore frequently are used as charge and feed ores. However, these materials are less dense than lump ore and lower in oxygen content. Consequently, more sinter is required to accomplish the same amount of oxidation.

The following table was compiled from Bureau of Mines surveys. There are no comparable data for previous years.

Metalliferous materials consumed in steel furnaces in he United States in 1943, by districts, in net tons

District	Iron ore		Sinter	Manganese ore		Ferro-alloys	Iron and steel scrap		Pig iron
	Domestic	Foreign		Domestic	Foreign		Home	Purchased	
Northeastern	4,470,850	46,939	1,386,715	1,343	12,992	(1)	26,982,861	15,802,749	50,025,495
Southeastern	29. 851	--------	90,225	--------	--------	(1)	983,661	247. 653	2,580,269
Western	73,576	--------	13,421	4,721	14. 993	(1)	1,121,849	2,370,298	1,153,590
	4,574,277	46,939	1,490,361	6,064	27,985	1,828,000	29,088,371	18,420,700	53,759,354

[1] Separation by districts not available.

FOREIGN TRADE

Imports and exports of iron and steel products are given in detail in the following tables:

Iron and steel imported for consumption in the United States, 1942–43, by commodities

Commodity	1942		1943	
	Net tons	Value	Net tons	Value
Semimanufactures:				
Steel bars:				
Concrete reinforcement	12	$2,442	56	$6,596
Solid or hollow, n. e. s.	590	81,142	2,740	409,064
Hollow and hollow drill steel	5	952	9	2,008
Bar iron	1	331	3	460
Wire rods, nail rods, and flat rods up to 6 inches in width	58	14,165	31	3,181
Boiler and other plate iron and steel, n. e. s.	226	23,711	397	31,933
Steel ingots, blooms, and slabs	6,903	193,244	346	46,984
Billets, solid or hollow	319	42,016	3,001	578,581
Die blocks or blanks, shafting, etc.	54	13,264	412	250,269
Circular saw plates	1	512	3	1,712
Sheets of iron or steel, common or black and boiler or other plate iron or steel	21	1,400	5	2,548
Sheets and plates and steel, n. s. p. f.	7	5,494	62	5,883
Tin plate, terneplate, and taggers' tin	150	35,627	113	27,136
Manufactures:				
Structural iron and steel	166	16,110	170	27,781
Rails for railways	13,084	363,636	6,307	123,556
Rail braces, bars, fish plates or splice bars, and tie plates	1,350	63,304	1,077	45,049
Pipes and tubes:				
Cast-iron pipe and fittings	2	744	25	3,426
Other pipes and tubes	634	86,754	596	126,583
Wire:				
Barbed	(1)	5	60	9,958
Round wire, n. e. s.	90	10,500	103	16,206
Telegraph, telephone, etc., except copper, covered with cotton, jute, etc.	51	25,889	432	149,295
Flat and steel strips not thicker than ¼-inch and not over 16 inches wide	284	243,013	158	168,246
Rope and strand	38	9,531	348	147,353
Hoop, band or strips, or scroll iron or steel, n. s. p. f.	1	232	2	98
Nails	238	11,992	15	2,090
Castings and forgings, n. e. s.	446	181,338	1,083	667,510

[1] Less than 1 ton.

Iron and steel exported from the United States, 1942–43

Article	1942		1943	
	Net tons	Value	Net tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	2,196,424	$92,344,860	2,055,913	$92,087,343
Iron and steel bars and rods:				
Iron bars	5,098	532,682	4,382	562,800
Concrete reinforcement bars	74,917	4,490,185	75,484	4,668,549
Other steel bars	557,123	74,444,265	548,935	79,457,312
Wire rods	145,251	7,497,767	176,040	9,201,840
Iron and steel plates, sheets, skelp, and strips:				
Boiler plates	38,818	2,089,997	45,063	2,928,346
Other plates, not fabricated	402,576	27,222,716	685,454	42,505,668
Skelp iron or steel	170,876	7,662,716	116,323	4,901,579
Iron and steel sheets, galvanized	100,411	8,022,475	72,506	5,801,960
Steel sheets, black, ungalvanized	795,380	57,317,048	699,818	47,811,206
Iron sheets, black	14,940	1,120,434	4,650	337,600
Strip band, and scroll iron or steel:				
Cold-rolled	129,168	18,546,419	95,468	18,975,775
Hot-rolled	92,855	6,932,489	104,556	9,019,705
Tin plate, terneplate, and taggers' tin	665,029	70,661,492	444,135	46,613,683
Manufactures—steel-mill products:				
Structural iron and steel:				
Water, oil, gas, and other storage tanks complete and knocked-down material	27,945	3,319,686	29,162	4,209,184
Structural shapes:				
Not fabricated	191,127	9,318,126	187,810	9,473,200
Fabricated	33,236	3,994,370	46,544	5,726,487
Plates fabricated, punched, or shaped	12,699	1,352,387	24,160	2,767,806
Metal lath	1,156	198,301	530	101,953
Frames, sashes, and sheet piling	4,238	443,529	5,098	436,151
Railway track material:				
Rails for railways	256,159	11,514,650	311,860	12,880,342
Rail joints, splice bars, fishplates, and tie plates	31,586	2,126,532	57,475	3,744,192
Switches, frogs, and crossings	13,297	1,634,292	20,828	2,885,362
Railroad spikes	6,854	515,938	13,803	1,023,960
Railroad bolts, nuts, washers, and nut locks	3,751	649,043	5,099	848,605
Tubular products:				
Boiler tubes	30,320	4,473,105	56,698	9,172,391
Casing and oil-line pipe	136,826	12,299,547	113,234	10,643,733
Seamless black pipe, other than casing and oil line	61,287	7,122,361	83,350	8,934,718
Welded black pipe	115,275	10,377,210	93,320	9,044,827
Welded galvanized pipe	42,775	4,249,737	54,008	5,438,550
Malleable-iron screwed pipe fittings	5,024	1,893,847	5,805	2,145,184
Cast-iron screwed pipe fittings	1,430	368,859	2,074	506,829
Cast-iron pressure pipe and fittings	16,008	1,246,854	18,709	1,795,464
Cast-iron soil pipe and fittings	5,727	460,664	8,530	642,404
Riveted-steel or iron pipe and fittings	116,588	19,407,689	130,967	26,969,319
Wire and manufactures:				
Barbed	162,344	13,137,749	22,330	1,968,599
Galvanized wire	79,988	7,949,678	71,868	9,130,590
Iron or steel wire, uncoated	69,172	9,261,514	90,925	12,287,356
Wire rope, and strand	37,060	14,381,102	38,923	16,957,870
Woven-wire fencing and screen cloth	7,237	2,330,321	7,276	2,969,492
All other	27,772	8,079,671	35,248	10,977,067
Nails and bolts (except railroad):				
Wire nails	23,907	2,219,287	41,155	3,378,227
Horseshoe nails	795	202,363	1,185	314,468
All other nails, including tacks and staples	7,070	1,085,103	7,285	1,266,443
Bolts, nuts, rivets, and washers (except railroad)	33,646	9,884,375	54,507	14,318,184
Castings and forgings:				
Horseshoes and calks	71	12,199	155	23,288
Iron and steel, including car wheels and axles	161,655	40,638,672	222,637	50,680,156
Advanced manufactures:				
House heating boilers and radiators	----------	370,922	----------	410,973
Oil burners and parts	----------	989,981	----------	1,485,392
Tools:				
Axes	----------	514,676	----------	723,832
Shovels and spades	----------	570,362	----------	598,459
Hammers and hatchets	----------	457,448	----------	706,825
Saws, wood and metal cutting	----------	5,797,219	----------	6,622,240
All other tools	----------	51,733,910	----------	65,792,500

MANGANESE

By Norwood B. Melcher[1]

SUMMARY OUTLINE

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GENERAL PERSPECTIVE

The domestic manganese industry in 1943 was signalized by the Nation's ability to maintain comfortable ore stocks by continuing imports at a virtual pre-war level. This was achieved in spite of enemy submarine activity, which sought to create a shortage of this strategic metal in the United States when it was urgently needed to support steel production. The success of the import program has been the leading cause for permitting domestic production to lag considerably behind schedules made in 1941 and 1942. Several projects designed to supply a large proportion of our requirements during the war were either seriously delayed or deferred. Among these was the proposal[2] to build 12 concentrating plants in 8 States to utilize our large, low-grade ore reserves. Only 2 of these projects were completed—one at Las Vegas, Nev., designed to ship 100,000 tons of nodules per year, and one in Butte, Mont., to yield 20,000 tons annually. At the close of 1943, however, neither of these operations had begun to ship high-grade products.

Domestic shipments of manganese ore containing (natural) 35 percent or more manganese amounted to 205,173 short tons in 1943—8 percent more than in 1942 but 40 percent less than in 1918; in addition, 471,593 tons of ore containing (natural) 10 to 35 percent manganese and 1,251,275 tons containing 5 to 10 percent manganese were shipped during 1943. Consumption of manganese ore in the United States reached the record total of 1,588,323 tons during the year, imports amounted to 1,429,599, and total United States stocks of ore at the end of the year were 1,732,713 tons.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] Melcher, Norwood B., Manganese and Manganiferous Ores: Minerals Yearbook, 1941, pp. 583-584.

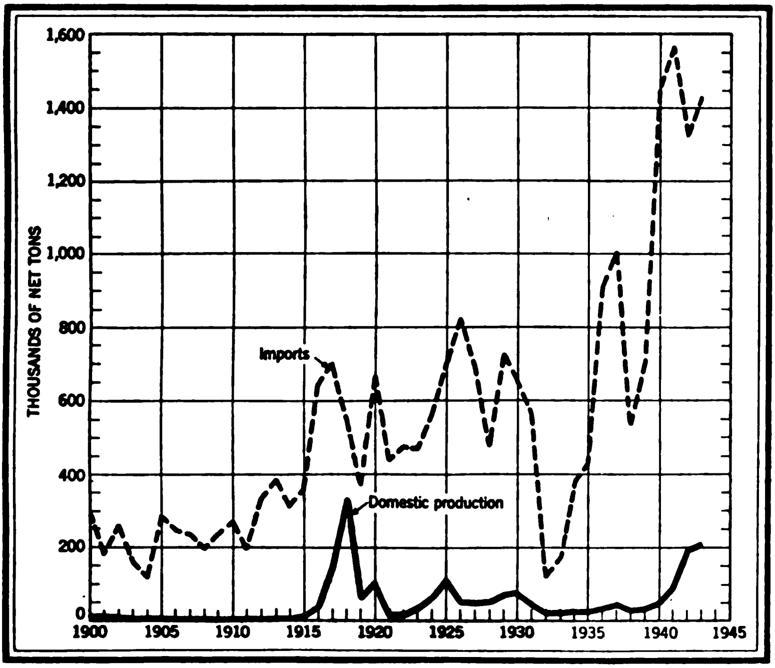

FIGURE 1.—Imports and domestic production (mine shipments) of manganese ore, 1900-1943. Statistics on imports shown in the graph represent general imports for 1900-1933, imports for consumption adjusted for changes in bonded warehouse stocks for 1934-39, and general imports for 1941-43.

Salient statistics of the manganese industry in the United States, 1925-29 (average) and 1939-43, in short tons

	1925-29 (average)	1939	1940	1941	1942	1943
Manganese ore:						
Total shipments containing 35 percent or more Mn	66, 429	32, 824	44, 936	87, 794	190, 748	206, 173
Shipments of metallurgical ore	[1] 46, 919	20, 810	30, 416	73, 852	177, 966	195, 096
Shipments of battery ore	19, 510	8, 699	10, 383	11, 399	12, 377	9, 973
Imports for consumption	672, 000	702, 384	1, 435, 928	1, 714, 581	1, 583, 024	1, 511, 630
Ferro-alloys:						
Production of ferromanganese	343, 123	302, 524	514, 682	580, 704	661, 338	702, 484
Imports of ferromanganese [2] [3]	[4] 56, 661	37, 424	9, 601	5, 696	11, 635	990
Production of spiegeleisen	106, 919	102, 470	114, 119	177, 915	186, 026	149, 036
Imports of spiegeleisen [3]	8, 174	42, 856	17, 455	4, 741	1, 990	3, 254
Exports of spiegeleisen and ferromanganese	4, 221	3, 274	14, 600	5, 155	7, 223	12, 824

[1] Includes small quantity of miscellaneous ore.
[2] Imports for consumption.
[3] Manganese content.
[4] Includes small quantity of other manganese alloys.

Metals Reserve Co.—In spite of the heavy drain on available manganese ore, Government stock piles declined only slightly during 1943. Contract purchases continued at a high rate during the year. Foreign ore in stock, mostly at Baltimore and Pittsburgh, totaled 738,686 tons on December 31, 1943. Domestic contract ore in stock at the close of the year amounted to 115,017 tons. These totals were 0.4 and 22 percent less, respectively, than a year ago. Stocks of small-lot purchases at the end of 1943 totaled 24,378 tons of metallurgical ore averaging (dry) 41.88 percent manganese and 640,469 tons of low-grade ore averaging (dry) 24.88 percent manganese. Most of the low-grade ore was held for concentration by the Manganese Ore Co. at Las Vegas, Nev., and the Domestic Manganese & Development Co. at Butte, Mont. Payments by the Metals Reserve Co. for the concentrating-grade ore totaled $4,807,264 at the end of 1943, or an average cost of $7.51 per short ton.

Price regulation.—The ceiling prices of manganese ore were virtually unchanged from 1942. Two additional minor amendments to Maximum Price Regulation 248 were issued in 1943. Amendment 2, effective February 15, 1943, exempted from price control any ore sold to a processor who uses it in the production of spiegeleisen or of ferromanganese containing less than 75 percent manganese, or who charges it directly in the production of steel or in foundry operations. Amendment 3 clarified the term "basing point" to mean that point which would result in the lowest cost for the buyer. Both amendments affected very small portions of the total manganese ore.

Revised Maximum Price Regulation 138, covering ferromanganese, manganese alloys, and metal, became effective July 1, 1943. This revision incorporated into the order all types of manganese alloying materials, whereas the original maximum price regulation covered only standard ferromanganese. The revised regulation (besides providing dollars-and-cents ceilings for standard ferromanganese, with specific differentials to cover crushing and grinding) established specific maximum prices for spiegeleisen, silicomanganese, manganese metal, and substandard ferromanganese, previously covered by the general maximum price regulation. The prices provided in the new revised regulation were essentially the same as those previously in effect. An exception was a small increase made to cover the expenses of freight and handling of the two smallest sizes of standard ferromanganese. Minor revisions to this regulation were published in Amendment 1 to Revised Maximum Price Regulation 138, effective August 7, 1943.

Earlier regulations issued by the Office of Price Administration are described in the Manganese and Manganiferous Ores chapter of Minerals Yearbook, 1942.

POST-WAR OUTLOOK

Both domestic production and imports of manganese ore after the war will depend on steel requirements and the action taken in maintaining manganese stock piles. However, it is likely that imports will continue at a fairly high rate in view of our relatively small domestic output.

If steel operations after the war should continue for some time at the wartime rate, manganese-ore requirements will continue at 1,500,000 tons per year. However, at, say, 60,000,000 short tons of steel and 13 pounds of contained manganese used per ton (13.3 pounds in 1943) of steel, 390,000 tons of contained manganese would be required for steel. Added to this requirement would be the foundry, battery, chemical, and miscellaneous industries, which would place the total annual requirements for manganese ore at around 1,000,000 tons. The average apparent consumption for the 5 pre-war years 1935–39 was 758,000 tons. Steel production for this same period averaged 46,574,000 tons.

Dry-cell battery manufacture will continue to use most of the nonmetallurgical ores. However, the use of manganese in agricultural fertilizers has developed into a substantial industry and may increase after the war. The use of manganese ore by the photographic industry for the manufacture of hydroquinone should continue to be a major use of chemical ore. Of our annual requirements for battery and chemical ores—35,000 and 15,000 tons, respectively—perhaps 25,000 tons of battery ore but virtually no chemical ore will be available from domestic sources.

Electrolytic manganese, which now constitutes less than 0.5 percent of total manganese supplies, is expected to increase gradually in usage through new metallurgical applications and its advantage as a steel furnace addition owing to the absence of carbon and its high manganese content. Relative to a domestic economy this metal is important because it can be produced from low-grade ores. Advancements in technology should lower the production costs of this material to make it more competitive with other manganese alloys.

DOMESTIC PRODUCTION

The following table shows the various types of manganiferous materials shipped by domestic producers from 1939 to 1943:

Manganiferous raw materials shipped by producers in the United States, 1939–43, in short tons

Year	Metallurgical ore				Battery ore	Miscellaneous
	Manganese ore (35 percent or more Mn)	Ferruginous manganese ore (10 to 35 percent Mn)	Manganiferous iron ore (5 to 10 percent Mn)	Manganiferous zinc residuum		
1939	20,810	268,289	526,067	144,747	8,699	3,315
1940	30,416	358,406	914,526	172,990	10,383	4,137
1941	73,852	512,162	918,725	282,049	11,399	2,543
1942	177,966	265,663	1,500,613	292,051	15,410	473
1943	195,096	468,862	1,251,275	270,328	12,704	104

Shipments of various grades of manganese-bearing ores during the last 5 years are given, by States, in the following tables. In addition, battery-grade ores were produced in California, Georgia, and Montana; a small quantity of miscellaneous ore came from Tennessee; and manganiferous zinc residuum was produced from New Jersey zinc ores.

Metallurgical manganese ore shipped from mines in the United States, 1939–43, by States, in short tons

State	1939	1940	1941	1942	1943
Alabama	115	64	------	26	------
Arizona	------	348	990	2,946	5,779
Arkansas	6,009	6,808	5,015	4,132	5,319
California	------	177	2,600	10,112	20,604
Colorado	------	251	190	513	707
Georgia	2,964	4,001	4,893	4,890	2,467
Idaho	------	------	34	------	36
Missouri	------	------	12	239	180
Montana	2,512	9,218	43,555	120,409	130,789
Nevada	------	235	2,937	6,112	10,451
New Mexico	380	50	------	1,267	469
North Carolina	48	------	35	------	140
Oklahoma	------	------	40	31	265
Oregon	------	------	85	45	143
Pennsylvania	------	------	------	22	------
South Carolina	------	------	------	------	312
South Dakota	------	------	------	81	12
Tennessee	8,183	7,821	4,394	2,247	2,501
Utah	56	30	43	970	91
Virginia	532	1,168	4,983	11,024	7,040
Washington	11	------	1,588	10,660	7,731
West Virginia	------	245	2,458	2,240	------
Wyoming	------	------	------	------	60
	20,810	30,416	73,852	177,966	195,096

Ferruginous manganese ore shipped from mines in the United States, 1939–43, by States, in short tons

State	1939	1940	1941	1942	1943
Ala	581	383	------	206	------
Ariz	------	------	17	------	498
Ark	2,206	1,204	3,381	14,067	8,207
Calif	------	97	464	4,659	8,492
Colo	8,418	3,699	------	44	------
Ga	8,015	11,298	6,715	10,514	5,835
Idaho	183	351	390	------	------
Mass	727	2,128	4,480	3,301	------
Mich	------	------	------	34,643	100,092
Minn	204,131	278,580	409,855	88,509	253,779
Mont	2,376	4,051	4,988	15,468	2,041
Nev	------	5,167	8,913	2,743	6,383
N. Mex	35,839	41,255	65,483	89,009	72,967
N. C	57	213	174	------	115
S. C	------	------	------	------	155
Okla	------	------	56	------	------
Tenn	329	2,606	1,865	916	803
Tex	------	------	------	142	------
Utah	293	2,354	551	78	18
Va	5,134	5,020	4,375	3,905	12,208
Wash	------	------	7	------	------
W. Va	------	------	448	560	------
	268,289	358,406	512,162	268,764	471,593

Manganiferous iron ore shipped from mines in the United States, 1939–43, by States, in short tons

State	1939	1940	1941	1942	1943
Alabama	------	------	------	162	------
Georgia	------	230	1,192	------	------
Michigan	------	20,851	------	------	------
Minnesota	526,067	893,359	917,533	1,500,451	1,251,275
Virginia	------	86	------	------	------
	526,067	914,526	918,725	1,500,613	1,251,275

Manganese and manganiferous ores shipped from mines in the United States in 1943, by States

	Metallurgical				Battery				Miscellaneous				Total			
	Shippers	Short tons		Value	Shippers	Short tons		Value	Shippers	Short tons		Value	Shippers	Short tons		Value
		Gross weight	Manganese content			Gross weight	Manganese content			Gross weight	Manganese content			Gross weight	Manganese content	
Manganese ore:[1]																
Arizona	24	5,779	2,236	$140,367									24	5,779	2,236	$140,367
Arkansas	20	5,319	1,845	183,772									20	5,319	1,845	183,772
California	50	20,604	8,618	674,930	4	2,625	1,047	(²)					[3] 50	23,229	9,665	(²)
Colorado	6	707	300	25,688									6	707	300	25,688
Georgia	2	2,467	940	(²)	1	22	12	(²)					3	2,489	952	(²)
Idaho	1	36	12	(²)									1	36	12	(²)
Missouri	1	180	81	(²)									1	180	81	(²)
Montana	16	130,789	79,056	4,839,728	2	7,326	3,130	(²)					18	138,115	82,186	(²)
Nevada	8	10,451	3,788	220,126									8	10,451	3,788	220,126
New Mexico	8	469	187	13,832									8	469	187	13,832
North Carolina	1	140	56	(²)									1	140	56	(²)
Oklahoma	1	265	106	(²)									1	265	106	(²)
Oregon	1	143	52	(²)									1	143	52	(²)
South Carolina	1	312	118	(²)									1	312	118	(²)
South Dakota	1	12	4	(²)									1	12	4	(²)
Tennessee	9	2,501	900	56,237					1	104	54	(²)	10	2,605	954	(²)
Utah	3	91	37	3,083									3	91	37	3,083
Virginia	17	7,040	2,946	238,435									17	7,040	2,946	238,435
Washington	1	7,731	3,870	(²)									1	7,731	3,870	(²)
Wyoming	1	60	25	(²)									1	60	25	(²)
Total	172	195,096	105,177	6,847,180	7	9,973	4,189	(²)	1	104	54	(²)	176	205,173	109,420	7,278,758
Ferruginous manganese ore:[4] [5]																
Arizona	4	498	139	4,336									4	498	139	4,336
Arkansas	10	8,207	1,761	69,902									10	8,207	1,761	69,902
California	3	7,673	1,544	56,472	3	819	170	(²)					6	8,492	1,714	(²)
Georgia	7	5,835	1,338	64,658									7	5,835	1,338	64,658
Minnesota	1	253,779	39,610	(²)									1	253,779	39,610	(²)
Montana	4	129	45	2,530	1	1,912	562	(²)					5	2,041	607	(²)
Michigan	1	100,092	10,520	(²)									1	100,092	10,520	(²)
Nevada	2	6,383	1,670	(²)									2	6,383	1,670	(²)
New Mexico	1	72,967	8,683	(²)									1	72,967	8,683	(²)
North Carolina	1	115	31	(²)									1	115	31	(²)
South Carolina	2	155	37	(²)									2	155	37	(²)
Tennessee	3	803	162	3,983									3	803	162	3,983
Utah	1	18	6	(²)									1	18	6	(²)
Virginia	8	12,208	1,884	73,451									8	12,208	1,884	73,451
Total	48	468,862	67,430	1,814,651	4	2,731	732	$52,504					52	471,593	68,162	1,867,155
Manganiferous iron ore:[6]																
Minnesota	3	1,251,275	95,351	2,654,897									3	1,251,275	95,351	2,654,897
Total	3	1,251,275	95,351	2,654,897									3	1,251,275	95,351	2,654,897

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[1] Containing 35 percent or more manganese (natural).

[2] Value included in total.

[3] 4 producers in California shipped both battery and metallurgical ore.

[4] Containing 10 to 35 percent manganese (natural).

[5] Excludes concentrating-grade ore shipped to Government stock piles.

[6] Containing 5 to 10 percent manganese (natural).

MINING BY STATES

Arizona.—The large producing manganese mines of Arizona in 1943 were the American mine in Gila County, the Black Warrior mine in Mohave County (Artillery Peak district), and the Denison and Shafer operations in Coconino County. The ferruginous manganese ore for metallurgical use came also from Coconino, Gila, and Mohave Counties. Not included in the statistical data for Arizona were 8,450 tons of concentrating-grade ore containing 2,135 tons of manganese, reported shipped to Government stock piles during 1943.

Arkansas.—The Arkansas Manganese Co. and the Walter H. Denison Manganese & Contracting Co., both of Batesville, continued to ship most of the manganese ore from Arkansas during 1943; however, there was a total of 20 active shippers during the year. Most of the ore came from Independence County, but small shipments were made from Izard, Pike, and Polk Counties. Included in the ferruginous manganese ore shipped was a small shipment from the Lindsey Cave mine in Stone County.

California.—Shipments from 19 counties comprised the State total in 1943. The largest producing mine was the Buckeye in Stanislaus County, which shipped 5,013 tons of ore averaging (natural) 39 percent manganese. The Barker mine in Santa Clara County shipped 1,844 tons of metallurgical ore averaging 38.25 percent Mn and 1,726 tons of battery ore averaging 66.30 percent MnO_2. The Iron Dyke and Lakeview claims in Plumas County shipped 2,211 tons of ore averaging 45.91 percent manganese.

A map showing the location and relative importance of California manganese deposits has recently been published by the California Department of Natural Resources.[3]

Colorado.—The bulk of the manganese ore produced in Colorado in 1943 came from the Whippoorwill mine in Ouray County. Small shipments were made from the Last Chance and Blackbird claims in Grand County, the Jo Dandy and Lucky Star claims in San Juan County, the Inspiration No. 1 claim in Gunnison County, and the Pershing mine in Saguache County.

Georgia.—Virtually all the manganese ore from Georgia in 1943 was shipped by Neel & Neel from the Aubrey mine in the Cartersville district; in addition, a small quantity of battery ore was shipped from the Etowah property in Bartow County, and a small shipment of metallurgical ore was made from Whitfield County. The ferruginous manganese ore was supplied by the Appalachian Manganese Corporation; the Aubrey, Bearden, Blue Ridge, Dobbins, and New Riverside Ochre Co. mines in Bartow County; and a small shipment from Murray County.

Idaho.—The small quantity of ore from Idaho was shipped from Bannock County by Peterson & Loose.

Michigan.—The Bengal mine on the Menominee range furnished the State total (all ferruginous manganese ore) in 1943. The ore averaged (natural) 10.51 percent manganese and 39.07 percent iron and contained 7.07 percent moisture.

Minnesota.—Upon a basis of contained manganese, Minnesota was the largest producing State in 1943. However, the ore was low-grade, the highest-grade being shipped from the Louise and Merritt mines, where it averaged (natural) 15.61 percent manganese. Shipments from these two mines totaled 253,779 tons of ferruginous manganese ore and 104,526 tons of manganiferous iron ore. The remainder of the manganiferous ore from Minnesota came from the Mahnomen and Sagamore mines and the Hillcrest-Alstead-Arko group in Crow Wing County, the Bennett mine in Itasca County, and the Corsica mine in St. Louis County.

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[3] State of California, Dept. of Natural Resources, Economic Mining Map of California No. 5—Manganese: 1943.

Missouri.—The output from Missouri in 1943 came from the Smokey Mountain mine in Shannon County.

Montana.—The major producer in Montana, and in the United States, was the Anaconda Copper Mining Co. at Butte, which produced and shipped 128,084 tons of sintered nodules, with a natural analysis as follows: Manganese 61.10 percent, iron 2.51 percent, silica 7.90 percent, phosphorus 0.069 percent, and moisture 0.018 percent. Most of the ore for this operation came from the Emma mine, but some from the Travona and Orphan Girl mines was used; these three mines are in the Butte district, Silver Bow County.

The battery ore was supplied by the Moorlight and Trout mines in the Philipsburg district, Granite County.

In addition to the shipments from Silver Bow and Granite Counties, small shipments of metallurgical ore were made from the Cook Prospect in Missoula County and the Manganese mine in Jefferson County.

The 400-ton custom mill of the Domestic Manganese & Development Co. at Butte was just getting into operation at the close of 1943. About 2,000 tons of high-grade nodules per month are expected to be attained from this plant in 1944.

Nevada.—The Golconda Mining Co., with operations at the Black Diablo mine, continued in 1943 to be Nevada's largest shipper. Shipments from the mine since 1929, when it is believed the first were made, are given as follows:

Manganese and ferruginous manganese ores shipped from the Black Diablo mine, 1929–43, in short tons [1]

Year	Short tons	Percent Mn (natural)	Year	Short tons	Percent Mn (natural)
1929	114	28.9	1942	5,896	35.3
1937	597	33.4		2,743	31.0
1940	235	35.8	1943	7,888	35.8
	5,167	27.9		5,066	27.3
1941	2,789	37.4			
	8,073	31.3			

[1] None reported 1930–36 and 1938–39.

Vietti & Caviglia shipped 1,352 tons of ore containing 38 to 40 percent manganese from the Manganese Mining Co. mine in White Pine County. Relatively small shipments were made also from Elko, Humboldt, Lander, and White Pine Counties.

The Manganese Ore Co., operating in Las Vegas Wash, Clark County, did not ship any concentrates in 1943. However, at the year end the task of saturating the large quantities of solutions with manganese was under way.

New Mexico.—The production of manganese ore in New Mexico in 1943 was small and came from Hidalgo, Luna, Sierra, and Socorro

Counties. All the ferruginous manganese ore shipped came from the Boston Hill mine in Grant County.

North Carolina.—The Clough Manganese mine in Alleghany County supplied the State total of manganese-bearing ore in 1943.

Oklahoma.—The Ouachita Manganese Co. shipped ore averaging (natural) 40 percent manganese from McCurtain County.

Oregon.—W. E. Warren shipped manganese ore from the McAdams property in Curry County in 1943.

South Carolina.—Abernathy & Kehaya shipped ore containing (natural) 37.7 percent manganese from McCormick County. Ferruginous manganese ore was shipped from Aiken and Greenwood Counties.

South Dakota.—The very small output of metallurgical-grade ore from South Dakota came from the Ballard and Fremont claims in Lawrence County.

Tennessee.—The Embree mine continued in 1943 to be the largest shipper in the State. Shipments from this mine amounted to 1,595 tons of metallurgical ore containing 548 tons of manganese and 652 tons of ferruginous ore containing 125 tons of manganese. The rest of the shipments from Tennessee came from Johnson, Monroe, and Unicoi Counties.

The manganiferous and ferruginous chert of Perry and Lewis Counties has recently been described by Burchard.[4]

Utah.—The small shipments from Utah were made from the Manganese King, San Raphael, and Wild Cat mines in Kane, Grand, and Utah Counties, respectively.

Virginia.—Seventeen shippers in Augusta, Bland, Craig, Rockingham, Smyth, and Wythe Counties supplied the State total in 1943. The larger operations during the year, in order of importance, were the Virginia Hardwood Lumber Co. mine in Bland County, the Glade Mountain mine in Smyth County, and the Old Dominion mine in Augusta County. The Old Dominion, which has not operated since 1918 when 672 short tons were shipped, came into production during the last quarter of 1943 and shipped 1,211 tons averaging 46.15 percent manganese. This mine is expected to ship 25,000 tons per year under full production.

Manganese deposits of the Elkton area are described by King [5] and those of the Lyndhurst-Vesuvius district by Knechtel.[6]

Washington.—The total production from Washington was hausmannite ore, averaging (natural) 50.05 percent manganese, from the Crescent mine in Clallam County.

IMPORTS OF MANGANESE ORE

In addition to the data given in the following table, general imports of ferruginous ore and residuum in 1943 amounted to 11,113 tons containing 3,223 tons of manganese; of this total, 2,206 tons came from the Arabian Peninsular States, 8,881 tons from Egypt, and 26 tons from Mexico. Imports for consumption of these materials, amounting to 11,148 tons containing 3,232 tons of manganese, were valued at $127,479.

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[4] Burchard, Ernest F., Manganiferous and Ferruginous Chert in Perry and Lewis Counties, Tenn. U. S. Geol. Survey Bull. 928-D, 1943, 50 pp.

[5] King, Philip B., Manganese Deposits of the Elkton Area, Virginia: Geol. Survey Bull. 940-B, 1943, 40 pp.

[6] Knechtel, Maxwell M., Manganese Deposits of the Lyndhurst-Vesuvius District, Augusta and Rockbridge Counties, Va.: Geol. Survey Bull. 940-F, 1943, 35 pp.

Manganese ore (35 percent or more Mn) imported into the United States, 1942–43, by countries

Country	General imports [1]				Imports for consumption [2]					
	Short tons				Short tons				Value	
	Gross weight		Mn content		Gross weight		Mn content			
	1942	1943	1942	1943	1942	1943	1942	1943	1942	1943
Battery grade:										
Canada	67	-------	36	-------	67	-------	36	-------	$2,068	-------
Cuba	-------	(3)	-------	(3)	-------	(3)	-------	(3)	-------	$20
French Equatorial Africa	-------	2	-------	1	-------	2	-------	1	-------	43
French Morocco	-------	403	-------	226	-------	403	-------	226	-------	11,100
Gold Coast	7,840	33,562	4,164	18,992	3,559	3,411	2,158	1,824	83,004	82,684
India and Dependencies	-------	3,584	-------	1,792	-------	3,584	-------	1,792	-------	37,600
Mexico	56	-------	22	-------	56	-------	22	-------	1,300	-------
	7,963	37,551	4,222	21,011	3,682	7,400	2,216	3,843	86,372	130,847
Other:										
Algeria	-------	10,440	-------	5,376	-------	10,440	-------	5,376	-------	117,896
Belgian Congo	2,224	11,109	1,101	5,606	2,869	17,880	1,546	9,075	31,908	410,338
Brazil	277,410	317,386	117,161	135,496	326,469	373,396	147,908	168,234	3,327,210	5,064,803
Canada	103	-------	46	-------	103	-------	46	-------	4,628	-------
Chile	1	10,649	(3)	5,230	4,463	16,336	2,113	7,893	68,542	291,364
Cuba	156,256	211,780	73,098	101,789	156,256	211,780	73,098	101,789	3,748,261	5,409,222
French Morocco	-------	6,497	-------	3,269	-------	6,497	-------	3,269	-------	245,005
French Oceania	-------	2	-------	1	-------	2	-------	1	-------	91
Gambia and Sierra Leone	-------	-------	-------	-------	976	-------	557	-------	23,053	-------
Gold Coast	126,354	94,507	64,318	46,836	185,677	213,362	93,540	110,876	2,664,841	3,629,524
India and Dependencies	496,497	572,255	251,466	286,421	600,759	459,357	301,724	229,804	8,444,228	5,097,281
Mexico	39,788	64,901	18,190	28,348	35,474	60,462	16,254	26,662	642,852	1,137,407
Netherlands Indies	8,059	-------	4,266	-------	9,067	-------	4,758	-------	203,875	-------
Nigeria	-------	-------	-------	-------	5,265	-------	3,015	-------	124,782	-------
Portuguese Guinea and Angola	-------	-------	-------	-------	-------	2,505	-------	1,330	-------	65,162
Union of South Africa	214,186	92,522	97,668	42,353	234,195	127,660	109,490	58,812	3,361,128	1,694,196
U. S. S. R.	-------	-------	-------	-------	17,769	4,553	9,200	2,341	277,216	73,060
	1,320,878	1,392,048	627,314	660,725	1,579,342	1,504,230	763,249	725,462	22,922,524	23,235,348
	1,328,841	1,429,599	631,536	681,736	1,583,024	1,511,630	765,465	729,305	23,008,896	23,366,195

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[1] Comprises ore received in the United States during year; part went into consumption, and remainder entered bonded warehouses.

[2] Comprises receipts during year for consumption and ore withdrawn from bonded warehouses during year (irrespective of time of importation).

[3] Less than 1 ton.

CONSUMPTION AND STOCKS OF MANGANIFEROUS RAW MATERIALS

The consumption of manganese ore in 1943 increased 7 percent over the 1,481,672 tons consumed in 1942. Of the 1943 total, 86 percent was of foreign origin, a significant change from the ratio of foreign ore used in 1942, when 97 percent (1,435,388 tons) came from foreign sources. Industrial stocks of manganese ore on December 31, 1943, were 4 percent less than the 885,744 tons on hand at the end of 1942.

The following table shows actual tons of manganese ore (containing 35 percent or more manganese, natural) and alloys consumed during 1943 and in stock at the end of the year.

Consumption and stocks of manganese ore and manganese alloys in the United States in 1943, gross weight in short tons

	Consumed	In stock Dec. 31, 1943[1]	
		At plant (including bonded warehouses)	In bonded warehouses
Manufacturers of manganese alloys:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	31, 148	5, 389	
Over 47 percent Mn (natural)	175, 554	10, 289	
Foreign	1, 291, 185	767, 075	310, 122
Total manganese ore	1, 497, 887	782, 753	310, 122
Ferromanganese		46, 692	34, 856
Spiegeleisen		8, 428	
Silicomanganese		(2)	(2)
Manganese briquets		(2)	(2)
Manufacturers of steel ingots:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	4, 773	1, 481	
Over 47 percent Mn (natural)	121	183	
Foreign	27, 003	28, 782	
Total manganese ore	31, 897	30, 446	
Ferromanganese:			
High-carbon	634, 976	94, 179	
Medium-carbon	9, 640		
Low-carbon	11, 561		
Total ferromanganese	656, 177	94, 179	
Spiegeleisen	150, 802	44, 658	
Silicomanganese	42, 886	8, 009	
Manufacturers of steel castings:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	909	931	
Over 47 percent Mn (natural)	261	200	
Foreign	982	765	
Total manganese ore	2, 152	1, 896	
Ferromanganese:			
High-carbon	47, 447	9, 263	
Medium-carbon	1, 440		
Low-carbon	688		
Total ferromanganese	49, 575	9, 263	
Spiegeleisen	12, 649	2, 755	
Silicomanganese	7, 778	1, 556	
Manufacturers of miscellaneous products:			
Ferromanganese:			
High-carbon	24, 874	6, 877	
Medium-carbon	3, 265		
Low-carbon	2, 397		
Total ferromanganese	30, 536	6, 877	
Spiegeleisen	12, 970	4, 291	
Silicomanganese	1, 185	829	104
Manganese briquets	4, 962	1, 875	355
Manufacturers of dry cells:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	5, 449	5, 200	
Over 47 percent Mn (natural)	7, 731	1, 172	
Foreign	25, 924	23, 644	15, 251
Total manganese ore	39, 104	30, 016	15, 251
Manufacturers of chemicals:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	66	391	
Over 47 percent Mn (natural)	74	771	
Foreign	17, 143	8, 359	
Total manganese ore	17, 283	9, 521	

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[1] Excluding Government stocks.

[2] Included under manufacture of miscellaneous products.

Consumption and stocks of manganese ore and manganese alloys in the United States in 1943, gross weight in short tons—Continued

	Consumed	In stock Dec. 31, 1943	
		At plant (including bonded warehouses)	In bonded warehouses
Grand total:			
Manganese ore:			
Domestic:			
35 to 47 percent Mn (natural)	42,345	13,392	
Over 47 percent Mn (natural)	183,741	12,615	
Foreign	1,362,237	828,625	325,373
Total manganese ore	[3] 1,588,323	854,632	325,373
Ferromanganese:			
High-carbon	707,297	149,074	33,512
Medium carbon	14,345	3,890	351
Low-carbon	14,646	4,047	993
Total ferromanganese	736,288	157,011	34,856
Spiegeleisen	176,421	60,132	
Silicomanganese	51,849	10,394	104
Manganese briquets	4,962	1,875	355

[3] The greater part of the ore consumed was used in the manufacture of ferromanganese and silicomanganese. Combining consumption of ore with that of ferromanganese and silicomanganese would result in duplication.

The following table shows ores available for consumption in the United States in 1943 but does not consider consumer or Government stocks at the beginning and end of the year.

Indicated consumption of manganiferous raw materials in the United States in 1943

	Ore containing 35 percent or more Mn		Ore and residuum containing 10 to 35 percent Mn		Ore containing 5 to 10 percent Mn	
	Short tons	Mn content (percent)	Short tons	Mn content (percent)	Short tons	Mn content (percent)
Domestic shipments	205,173	53.3	741,921	14.2	1,251,275	7.6
Imports for consumption	1,511,630	48.2	11,148	29.0	(1)	(1)
Total available for consumption	1,716,803	48.9	753,069	14.5	1,251,275	7.6

[1] Estimated as none consumed.

METALLURGICAL INDUSTRY

The steel industry in 1943 used an average of 13.3 pounds of manganese per short ton of steel produced—a considerable increase from 1942. Of the 1943 consumption, 11.7 pounds were in the form of ferromanganese, 0.7 pound as spiegeleisen, 0.6 pound as silicomanganese, and 0.3 pound as manganese ore used directly. In 1942 the consumption of manganese contained in ferromanganese, spiegeleisen, and silicomanganese amounted to 11.2 pounds, 0.6 pound, and 0.6 pound, respectively, per ton of steel; in addition, an undetermined amount of manganese ore was used.

The above data apply to the consumption of manganese ore in the manufacture of steel ingots and that part of steel castings manufactured by concerns which also produce steel ingots.

Open-hearth operations are the greatest users of manganese in the United States. Manganese is added to the open-hearth melt essentially as an alloying agent, a deoxidizer, and a desulfurizer. As an alloying agent, manganese has no marked effect on tensile strength of steel when below 0.3 or 0.4 percent. This is because other substances, especially iron oxide, mask the effect. Consequently, if the beneficial effects of manganese upon tensile strength are desired, it is important to maintain as much manganese as possible in the bath, as the amount to be added during recarburizing is reduced in direct proportion to the weight of the residual manganese.

Manganese is added to the bath near the end of the heat, in the form of a recarburizer, the original purpose of which was to raise the carbon content to the desired level. However, at present its most important purpose is to rid the bath of as much oxygen as possible. The recarburizer contains manganese, silicon, and carbon. It often consists of ferromanganese and ferrosilicon but has been replaced to some extent by silicomanganese, which is considered superior under certain conditions because the oxides formed from this alloy coalesce peculiarly and separate more easily from the steel, eliminating the so-called oxidized inclusions before the steel freezes. Unless manganese and silicon are added in quantities above that necessary to theoretically complete the oxidizing reactions, the effect will be incomplete. Consequently, the recarburizer is so calculated that about 0.50 percent manganese and 0.10 percent silicon are left in the open-hearth steel at the end of the heat.

Sulfur is eliminated from steel mainly through the formation of manganese sulfide, which separates from solution in the liquid bath and slowly rises to the surface. When in contact with a basic slag the manganese sulfide will convert to calcium sulfide and remain in the slag. As lime may be added only to basic furnaces, acid furnaces will not remove sulfur. The more manganese put in with the charge, the more sulfur is removed. For this reason, basic pig iron should be relatively high in manganese.

Ferromanganese.—The domestic output of ferromanganese in 1943, which increased 6 percent over 1942, was produced at the following plants:

Bethlehem Steel Co., Johnstown and Bethlehem, Pa.
E. J. Lavino & Co., Reusens, Va., and Sheridan, Pa.
Sloss-Sheffield Steel & Iron Co., North Birmingham, Ala.
Tennessee Products Corporation, Rockdale and Rockwood, Tenn.
Colorado Fuel & Iron Corporation, Pueblo, Colo.
Electro Metallurgical Co., Alloy, W. Va.
United States Steel Corporation, Etna and Clairton, Pa.

In addition to the foregoing plants, shipments were made by the Jones & Laughlin Steel Corporation, Aliquippa, Pa.

Fourteen percent of the total manganese ore used in 1943 for the production of ferromanganese was of domestic origin compared with 1 percent in 1942.

Ferromanganese and spiegeleisen imported into and made from domestic and imported ores in the United States, 1942–43, in short tons

	1942		1943	
	Alloy	Manganese	Alloy	Manganese
Ferromanganese:				
Imported	14,772	11,635	2,302	990
Domestic production	661,338	522,553	702,484	554,828
From domestic ore [1]	12,335	10,514	124,621	98,426
From imported ore [1]	649,003	512,039	577,863	456,402
Total	676,110	534,188	704,786	555,818
Ratio (percent) of Mn in ferromanganese of domestic origin to total Mn in ferromanganese made and imported		1.97		17.71
Number of plants making ferromanganese	18		11	
Spiegeleisen:				
Imported	1,990	[1] 398	3,254	[1] 651
Domestic production	186,026	36,071	149,036	28,954
From domestic ore	186,026	36,071	149,036	28,954
From imported ore				
Total	188,016	36,469	152,290	29,605
Ratio (percent) of Mn in spiegeleisen of domestic origin to total Mn in spiegeleisen made and imported		98.51	97.86	97.80
Number of plants making spiegeleisen	4		6	
Total available supply of metallic manganese in ferromanganese and spiegeleisen		570,657		585,423
Percent of available supply of manganese in—				
Ferromanganese and spiegeleisen imported		2.11		0.28
Ferromanganese made from imported ore		89.73		77.96
Spiegeleisen made from imported ore				
Ferromanganese made from domestic ore		1.84		16.81
Spiegeleisen made from domestic ore		6.32		4.95
Ferromanganese and spiegeleisen made from domestic ore		8.16		21.76
Spiegeleisen made and imported		6.39		5.06
Total open-hearth, Bessemer, and electric steel	86,029,921		88,836,366	

[1] Estimated.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1939–43

Year	Ferromanganese produced			Materials consumed (short tons)				Manganese ore used per ton of ferromanganese made (short tons)
	Short tons	Manganese contained		Manganese ore (35 percent or more Mn, natural)		Iron and manganiferous iron ores	Cinder, scale, and purchased scrap	
		Percent	Short tons	Foreign	Domestic			
1939	302,524	79.24	239,725	563,344		9,323	7,000	1.862
1940	514,682	79.45	408,903	976,332	13,419	5,889	8,868	1.923
1941	580,704	79.48	461,539	1,122,187	9,414	5,166	6,031	1.949
1942	661,338	79.01	522,553	1,273,596	17,572	19,545	4,634	1.952
1943	702,484	78.98	554,828	1,181,929	199,567	1,684		1.967

Manganese ore used in manufacture of ferromanganese in the United States, 1939–43, by sources of ore

Source of ore	1939		1940		1941		1942		1943	
	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)
Domestic			13,419	55.89	9,414	41.61	17,572	39.69	199,567	57.86
Foreign:										
Africa	144,734	48.14	233,370	45.89	221,940	47.11	274,450	46.61	340,985	45.21
Brazil	65,278	43.75	189,389	42.39	328,769	42.29	342,538	41.55	254,215	39.72
Canada									44	45.00
Chile	959	48.16	6,076	46.13	4,715	45.81	5,677	46.64	5,837	48.95
Cuba	66,079	48.16	112,859	48.59	135,581	48.47	171,029	46.33	194,780	45.91
India	96,666	49.84	188,079	49.73	[1] 250,425	49.85	340,096	49.75	255,897	49.10
Java							2,189	46.28		
Mexico					1,755	46.27	2,013	45.31	10,436	41.03
Philippine Islands			12,768	47.16	6,236	48.32	19,741	46.05	27,233	46.04
U. S. S. R	189,628	47.54	87,286	47.85	[1] 145,325	48.12	64,051	48.06	3,129	45.19
Undistributed			46,505	38.75	[1] 27,441	46.26	[2] 51,812	45.75	[3] 89,373	49.21
	563,344	47.72	989,751	46.45	1,131,601	46.54	1,291,168	45.99	1,381,496	47.11

[1] Tonnage entered under "Undistributed" comprises ore from India and U. S. S. R.; separation as to source not reported by consumer.

[2] Source of ore not reported by consumer. [3] "Orient" reported by consumer as source of ore.

Shipments of ferromanganese in 1943 increased 10 percent over 1942. The record of shipments for the past 5 years follows.

Ferromanganese shipped from furnaces in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	332,227	$24,137,211	1942	659,219	$82,726,298
1940	503,291	42,755,485	1943	722,668	93,481,580
1941	619,395	69,378,004			

Imports for consumption of ferromanganese decreased 84 percent from 1942, and exports increased 75 percent.

Ferromanganese imported into and exported from the United States, 1939–43

Year	Imports for consumption			Exports[1]	
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Value
1939	46,175	37,424	$2,935,214	3,274	$247,796
1940	11,613	9,601	1,321,369	14,600	1,366,087
1941	7,032	5,696	557,150	5,155	771,575
1942	14,772	11,635	1,274,749	7,165	976,928
1943	2,302	990	160,600	12,510	1,717,888

[1] 1939–41: Includes spiegeleisen; not separately classified before July 1, 1941.

Ferromanganese imported for consumption in the United States, 1942–43, by countries

Country	1942			1943		
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Mn content (short tons)	Value
Canada	6,453	5,040	$654,219			
India and Dependencies				2,302	990	$160,600
United Kingdom[1]	8,319	6,595	620,530			
	14,772	11,635	1,274,749	2,302	990	160,600

[1] United Kingdom of Great Britain and Northern Ireland.

The quoted price of ferromanganese (delivered Pittsburgh) decreased from $125.58 per short-ton in May to $125.29 in June as a result of a 6-percent decrease in freight, effective June 1, 1943. However, the base price at seaboard of $135.00 per long ton ($120.54 per short ton) remained unchanged.

Prices per short ton of ferromanganese in the United States, 1941–43, by months[1]

Month	1941	1942	1943	Month	1941	1942	1943
January	$111.90	$111.90	$125.58	July	$111.90	$125.58	$125.29
February	111.90	111.90	125.58	August	111.90	125.58	125.29
March	111.90	111.90	125.58	September	111.90	125.58	125.29
April	111.90	111.90	125.58	October	111.90	125.58	125.29
May	111.90	125.58	125.58	November	111.90	125.58	125.29
June	111.90	125.58	125.29	December	111.90	125.58	125.29

[1] Steel, vol. 114, January 3, 1944.

Spiegeleisen.—Production and shipments of spiegeleisen decreased 20 and 19 percent, respectively, from 1942. The decrease was due largely to the comfortable position held by ferromanganese during 1943.

Spiegeleisen produced and shipped in the United States, 1939–43

Year	Produced (short tons)	Shipped from furnaces		Year	Produced (short tons)	Shipped from furnaces	
		Short tons	Value			Short tons	Value
1939	102,470	94,908	$2,484,042	1942	186,026	186,163	$5,931,728
1940	114,119	119,512	3,487,565	1943	149,036	150,136	4,827,954
1941	177,915	181,177	5,793,481				

Spiegeleisen was manufactured at the following plants during 1943:

E. J. Lavino & Co., Reusens, Va.
New Jersey Zinc Co., Palmerton, Pa.
Sloss-Sheffield Steel & Iron Co., North Birmingham, Ala.
Inland Steel Co., East Chicago, Ind.
United States Steel Corporation, Duquesne and Clairton, Pa.

All the spiegeleisen produced in the United States in 1943 was made from domestic raw materials. Imports of spiegeleisen for consumption increased 64 percent over 1942; all came from Canada.

Spiegeleisen imported for consumption in the United States, 1939–43

Year	Short tons	Value
1939	42,856	$1,329,814
1940	17,455	638,732
1941	4,741	215,108
1942	1,990	$95,853
1943	3,254	140,247

The prices of spiegeleisen (20-percent) at producers' furnaces, as quoted by Steel, remained constant at $32.14 per short ton during 1943.

Manganiferous pig iron.—Pig-iron blast furnaces used 52,067 tons of manganiferous zinc residuum and a total of 1,305,005 tons of domestic ore containing over 5 percent (natural) manganese in 1943; of this ore, 1,360 tons contained 35 percent or more manganese, 242,961 tons contained 10–35 percent manganese, and 1,060,684 tons contained 5–10 percent manganese. In addition, 18,423 tons of foreign ore containing over 35 percent manganese and 9,509 tons containing 10–35 percent manganese were used during the year.

Foreign ferruginous manganese ore and manganiferous iron ore consumed in the United States, 1941–43, in short tons

Source of ore	Ferruginous manganese ore			Manganiferous iron ore		
	1941	1942	1943	1941	1942	1943
Australia				2,265	790	
Brazil	8,313	9,173				
Cuba		4,777	9,509			
Sweden					990	
	8,313	13,950	9,509	2,265	1,780	

BATTERY AND MISCELLANEOUS INDUSTRIES

Manganese ore for battery use should have a high content of available oxygen with minimum iron and be relatively free from such metals as arsenic, copper, nickel, or cobalt, which are electronegative to zinc. Chemical ore has a wide range in analyses and a great many uses; the bulk is used in photography (in the manufacture of hydroquinone), in fertilizers, and in coloring agents for paints and ceramics.

Data covering production, imports, consumption, and stocks of such ores are given elsewhere in this chapter.

PRICES

Ceiling prices on foreign ore in effect at the close of 1942 continued throughout 1943. However, the Metals Reserve Co., which is exempt from maximum price regulations, issued a new purchasing schedule [7] which increased substantially the prices paid for certain domestic ores. Thirty-five-percent ore formerly purchased by the Metals Reserve Co. at $19.50 per long dry ton (disregarding penalties) was increased in price to $28.00 per ton. This schedule was designed to increase the price paid by the Metals Reserve Co. for ores containing just over 35 percent manganese and at the same time to maintain the previous price of $1.00 per long-ton unit ($48.00 per long dry ton) for standard 48-percent ore. This action did much to aid small producers of marginal ore.

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[7] Metals Reserve Co., Information Concerning Purchase of Domestic Manganese Ores and Concentrates: May 15, 1943 (revised), Washington, D. C.

The average mine value reported for ore containing 35 percent or more manganese during 1943 was 73 cents per long-ton unit compared with 72 cents in 1942. Quotations on imported ore in the following table are from Engineering and Mining Journal. A duty of one-half cent per pound of contained manganese is imposed on all imported manganese ore except that from Cuba and the Philippine Islands, which enters duty free.

Domestic prices of imported metallurgical manganese ore in 1943, in cents per long-ton unit

[C. i. f. North Atlantic ports, cargo lots, exclusive of duty

	Beginning of year	End of year		Beginning of year	End of year
Brazilian, 48 percent Mn	$0.788	$0.788	Cuban (not dutiable)—Con.		
Chilean, 48 percent Mn	.788	.788	48 percent Mn	$0.900	$0.900
South African, 48 percent Mn.	.788	.788	Indian:		
Cuban (not dutiable):			50 percent Mn	.798	.798
51 percent Mn	.915	.915	48 percent Mn	.788	.788

According to Engineering and Mining Journal, prices for chemical ores per long ton in carlots at the end of 1943 were as follows: Brazilian, 80 percent MnO_2 minimum, $55.00; Javan or Caucasian, 85 percent minimum, $70 to $75; domestic, 70 to 72 percent, $45 to $50 f. o. b. mines.

WORLD PRODUCTION

Manganese ore produced in principal countries of the world, 1938–43, in metric tons[1]

[Compiled by B. B. Waldbauer]

Country [1]	Percent Mn	1938	1939	1940	1941	1942	1943
North America:							
Canada (shipments)			359	138	(2)	395	
Costa Rica		304	(3)	(2)	(2)	(2)	(2)
Cuba	36–50+	123,844	102,415	119,852	251,385	249,255	[4] 311,214
Mexico (metal content)	44	117	27	307	979	11,493	22,946
United States:							
Continental (shipments)	35+	25,727	29,777	40,767	79,646	173,043	186,129
Puerto Rico (exports)	48–51	1,039					
South America:							
Argentina [5]	35–38	437	651	710	1,476	1,520	(2)
Bolivia (exports)	50		500		(2)	272	(2)
Brazil	38–50	306,025	257,752	313,391	[6] 437,402	[6] 306,241	[6] 275,552
Chile	40–50	19,319	12,550	11,620	35,815	71,292	(2)
Peru		24	96	283	30	(2)	(2)
Europe:							
Bulgaria	30–45	1,887	944	2,000	(2)	(2)	(2)
Germany	30+	163	(3)	(2)	(2)	(2)	(2)
Greece	30+	7,075	11,178	(2)	(2)	(2)	(2)
Hungary	35–48	22,221	(3)	(2)	(2)	(2)	(2)
Italy	34–37	48,282	54,100	(2)	(2)		(2)
Portugal	40+	1,008	353	1,059	1,815	6,820	[7] 9,190
Rumania	30–36	60,256	41,546	(2)	(2)	[8] 35,000	(2)
Spain	40+	1,319	4,711	5,865	9,923	19,698	24,027
Sweden	30–50	5,347	5,934	(2)	(2)	(2)	(2)
U. S. S. R	41–48	2,272,800	(2)	2,800,000	[9] 2,393,000	[9] 1,823,000	(2)
Yugoslavia	32–38	3,759	5,655	(2)	[10] 4,724	(2)	(2)

See footnotes at end of table.

Manganese ore produced in principal countries of the world, 1938–43, in metric tons [1]—Continued

[1] Country	Percent Mn	1938	1939	1940	1941	1942	1943
Asia:							
China (exports)	45–46	1,247	1	(2)	(2)	(2)	(2)
India:							
British	47–52	983,464	858,220	882,947	[8] 1,000,000	(2)	(2)
Portuguese	42–50+	9,478	8,204	6,525	(2)	(2)	(2)
Indochina	-------	2,214	2,440	[8] 2,000	(2)	(2)	(2)
Japan	49–51	[8] 80,000	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	50–55	9,687	12,074	11,569	(2)	(2)	(2)
Philippine Islands	45–50	58,143	29,394	52,166	[7] 50,570	(2)	(2)
Turkey	30–50	2.186	3,339	460	1,360	[8] 1,000	(2)
Unfederated Malay States	30	32,483	31,952	11,702	(2)	(2)	(2)
Africa:							
Belgian Congo	50+	7,725	(2)	18.369	30,500	29,000	[8] 30,000
Egypt	30+	153,112	119,882	64,912	2,175	8,169	7,079
Gold Coast	50+	408,452	388,131	442,998	498,881	691,016	[8] 700,000
Morocco:							
French	40–50+	86,597	50,803	(2)	(2)	[11] 14,299	(2)
Spanish	38	152	(2)	(2)	(2)	(2)	(2)
Northern Rhodesia	30–48	2,779	3,018	3,550	4,775	(2)	(2)
Union of South Africa	30–51	551,739	419,697	412,071	445,893	394,445	[7] 179,991
Oceania:							
Australia:							
New South Wales	-------	221	148	1,024	1,485	(2)	(2)
Queensland	-------	382	---------	387	209	(2)	(2)
South Australia	-------	---------	7	10,827	11,406	(2)	(2)
New Zealand	-------	91	494	996	764	326	(2)
Papua [12]	-------	---------	55	198	408	(2)	(2)
	-------	5,291,000	5,169,000	(2)	(2)	(2)	(2)

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[1] In addition to countries listed Belgium produces manganese ore, but data of output are not available. Czechoslovakia reports a production of manganese ore, but as it has been ascertained that the product so reported averages less than 30 percent Mn and therefore would be considered ferruginous manganese ore under the classification used in this report, the output has not been included in the table.

[2] Data not available.

[3] Estimate included in total.

[4] Dry weight.

[5] Shipments by rail and river.

[6] Exports.

[7] January to September, inclusive.

[8] Estimate.

[9] Estimate excludes Ukraine.

[10] Croatia only.

[11] January to June, inclusive.

[12] Year ended June 30 of year stated.

Brazil.—Brazil continued to be second only to British India as a source of United States imports of manganese ore in 1943; however, it dropped below Cuba as a producer, because of the relatively long shipping distance from Brazil to the United States.

Virtually all the manganese-ore output of Brazil comes from the State of Minas Gerais. The two important districts of the State are the Miguel-Burnier district, 310 miles north of Rio de Janeiro on the Central Railway of Brazil, and the Lafayette (Queluz) district, about 20 miles south of Miguel-Burnier and 283 miles from Rio de Janeiro.

The Miguel-Burnier deposits consist chiefly of a mixture of psilomelane and pyrolusite, averaging 50 percent manganese, 1 percent silica, and 0.03 to 0.05 percent phosphorus. The draw-back to the district is the fact that the beds dip steeply and are relatively small in extent.

The Morro da Mina mine in the Lafayette district is the largest manganese mine in Brazil. The ore bodies lie at the top and on the flanks of a hill as a series of overlapping lenses. The ore, which consists mainly of psilomelane with manganite and pyrolusite, is mined in open cuts and is usually screened. The fine ore is the higher grade, but the coarse grade has been exported to some extent. The mine is operated by the Cia Meridional de Mineracão, a subsidiary of the United States Steel Corporation.

Cuba.—Cuba became the largest producer of manganese ore in the Western Hemisphere in 1943. Imports into the United States increased 36 percent over 1942, and the Metals Reserve Co. continued to stock-pile ore in Cuba to have manganese ore readily available without utilizing urgently needed ship bottoms. At the end of 1943, these stocks totaled 270,026 short tons. Park [8] has recently described the manganese ores of Cuba as follows:

> Manganese has been found in every Province of Cuba, but the deposits that have been most productive and that contain the largest known reserves are in Oriente Province. The Oriente deposits lie in a broad zone about the Sierra Maestra, which consists largely of Eocene volcanic rocks and limestone; with few exceptions they are either bedrock deposits in the Eocene rocks or the superficial accumulations known as granzon.
>
> The bedrock deposits are mainly either in tuff or in limestone. Their manganese minerals are mostly the oxides pyrolusite, psilomelane, and manganite. Much "bayate", or jasper, is associated with the ores, and zeolites are locally abundant. The manganese is thought to have been deposited by warm springs, which were active during the last stages of the Eocene volcanism that centered in the Sierra Maestra. Textural features show that the manganese oxides were in part deposited in open spaces—conduits of the spring waters and pore spaces in the rocks—and in part by replacement of the rocks. Some of the deposits are bedded and appear to be primary accumulations of manganese oxides, presumably derived from spring waters discharged into the sea. The lithologic character of these bedded ores indicates that they were deposited contemporaneously with the associated sedimentary rocks.
>
> The granzon ore consists of nodules or pellets of the manganese oxides found in soil or subsoil near the outcrops of the bedrock deposits. It is not concentrated in streams as gravel, but appears to be most abundant in nearly level areas or playas where surface water stands intermittently or runs off slowly.
>
> From 1888 to 1940, the Cuban deposits yielded a total of 1,237,858 long tons of manganese ore, valued at $21,386,706.

Chile.—General imports of manganese ore from Chile increased from a single ton in 1942 to 10,649 short tons in 1943. In addition, 182,953 tons were held in stock in Chile by the Metals Reserve Co.

Gold Coast.—Gold Coast was the third largest producer of manganese ore in the world in 1943. All the output (700,000 tons in 1943) from Gold Coast is supplied by the Nsuta mine, largest individual manganese producer in the world. The deposits, consisting essentially of pyrolusite and psilomelane, have been traced almost continuously from near the Sekondi-Kumasi Railroad for about 2½ miles northeast along two parallel ridges. The accessibility is unusual, the deposits being only 39 miles by rail from the port of Takoradi.

U. S. S. R.—Recent reports from the Soviet Union indicate that the 1942 production was considerably higher than estimated earlier. Excluding the Ukraine, which was occupied by enemy troops, it is estimated that 1,823,000 metric tons were produced in 1942. When this chapter was written (May 1944) no information was available on 1943 output, but it is likely that U. S. S. R. retained its position as the leading manganese-ore producer of the world.

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[8] Park, Charles F., Jr., Manganese Deposits of Cuba: Geol. Survey Bull. 935-B, 1942, 97 pp.

CHROMITE

By C. E. Nighman and Martin L. Kenely

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SUMMARY

The major development in chromite in 1943 was the transition of the supply situation from one of anxiety to a comfortable working margin; it was achieved by a combination of the maintenance of foreign supplies, a peak domestic production, and the successful fruition of control actions taken by the Government war agencies.

Domestic production reached the unprecedented total of 160,120 short tons of chromite—a peak that may never again be equaled unless a similar emergency arises. Although below the quality standards normally set by industrial consumers, the output of domestic mines played an important role in guarding against disaster to foreign sources of supplies.

Supplies from abroad were lower than in either 1941 or 1942 but were high enough to provide a safe stock-pile margin under the revised stock-pile program requiring only 6 months stocks to be within the country. The almost complete defeat of the Axis attacks on shipping lanes made unlikely any recurrence of the critical supply conditions of 1941 and 1942.

Salient statistics of chromite in the United States, 1942–43

	1942		1943	
	Short tons	Value	Short tons	Value
New supply:				
Domestic production (shipments)	112,876	$2,994,081	160,120	$4,820,461
Imports for consumption	981,607	14,200,159	928,576	16,432,511
Total	1,094,483	17,194,240	1,088,696	21,252,972
Distribution:				
Consumption by industry	891,952	(1)	964,600	(1)
Exports	4,743	163,420	26,259	896,174
Additions to stocks	197,788	(1)	97,837	(1)
Total	1,094,483	17,194,240	1,088,696	21,252,972

(1) Not available.

Consumption of chromite totaled 964,600 short tons—a substantial increase over 1942 and a record level that will not be equaled in 1944 should that for the first quarter be maintained for the balance of the year.

An important feature of the international situation was the Turkish decision to halt exports of chromite to Germany. This decision, made early in 1944, may prove to be an important factor in the war, as the supply sources remaining available to Germany are not considered adequate to maintain its great demands.

Experience in the early months of 1944 suggests that domestic production probably will be less than half that for 1943. At this writing (June 1944) all but one of the six largest producers are closed and are not expected to resume operations. Imports probably will again be lower, but the almost complete freedom from Axis activity of shipping lanes to Africa—our most important source of metallurgical ore—makes this situation one to be handled on nearly peacetime standards, rather than on the driving requirements of a war emergency. Consumption for the first quarter of 1944 is lower than in the comparable period for 1943, but this condition can change overnight as losses of material on the war front or shifts in consumption patterns affect military demands.

POST-WAR OUTLOOK

The outlook for chromite indicates a higher consumption in the post-war years than in those just before the war. The backlog of postponed consumption for normal industrial and civilian uses is enormous. Construction, railroad, and automobile-industry demand, coupled with the entire reconversion program and aid toward rebuilding war-desolated countries, should elevate chromite consumption to new peacetime levels. Restraining factors—largely the result of wartime developments—such as the competition of low-alloy and heat-treated steels, competition from light metals, and the new emphasis on "performance" specifications—may create a highly competitive market, but the over-all demand should still be high. Factors affecting the supply side and as yet undeterminable in their effects will be the accessibility of foreign sources of chromite, the disposition of secondary metal (both war scrap and unused war materials), the speed of reconversion, and post-war financing problems of private industry.

WAR PRODUCTION BOARD REGULATIONS

Changes in Government controls during 1943 were largely in the nature of refinements of those previously established, except for the institution of complete allocation of chrome chemicals in September. Primary chrome chemicals for use in tanning, pigments, chromic acids, surface treatment of metals, plating, textile processing, and dyes became critically short in supply for war needs, largely because of inability to expand manufacturing capacity, coupled with labor-supply problems.

In April the War Production Board ordered a decrease in the quality of chromite used in manufacturing high-carbon ferrochromium. Under the terms of the order, producers were instructed to use chromite having a weighted chrome:iron ratio not exceeding 2.6:1. Flexibility in operations was allowed under the weighting rule; for part of a month a higher grade of chromite could be used, providing the average for the month was not over 2.6:1.

The Board also acted to reduce ferrochromium consumption; the requirement was established in February that at least 30 to 40 percent of the chromium content of stainless steel was to be obtained from scrap and ore. It was emphasized that the new economies were minimum, and producers were requested to institute even greater economies whenever possible.

Changes in the point at which control was exercised took place with regard to high-carbon ferrochromium, briquets, and high-carbon Chrom-X. Control was relinquished over consumers' stocks and placed on producers' shipments instead. Control over actual consumption was not relinquished, however.

Chromium metal for metallurgical uses was freed to some extent for the smaller consumers. Deliveries of 3,000 pounds or less to a single customer in any one month were permitted without the need for filing report forms with the Board. However, early in 1944 the supply situation for chromium metal again became critical, and the 3,000-pound free-delivery allowance was reduced to 250 pounds.

MARKET AND PRICES

Since November 1941 the Metals Reserve Co. has been the principal buyer of chromite. The original terms of purchase contracts have been lowered progressively in respect to acceptable minimum quantities and quality, but prices have been raised. The small lots purchasing program, established in March 1942, has gone through the same experience. The published purchasing terms for 1941 and 1942 are described in Minerals Yearbook for those years.

On May 15, 1943, the purchasing regulations for contract agreements were revised so that the minimum quantity became 500 long tons—a 50-percent cut from the previous minimum of 1,000 long tons.

A major revision was the elimination of detailed specifications. Before May 15 there had been various restrictions on the maximum allowable content of such impurities as silica, phosphorus, and sulfur, but these were now dropped. Only the measure of chromic oxide content and the chrome:iron ratio were retained as guides to quality, acceptability, and the price to be paid.

Price-determining specifications also were revised. The classifications of High Grade, and Low Grades A and B were discontinued in the revised price schedule. A base price was set for chromite with a chromic oxide content of 48 percent and a chrome:iron ratio of 3:1, which are traditional bench marks in commercial trade circles. Various penalties and premiums were set for deviations downward or upward from the basic assay.

A price of $52.80 was set for chromite meeting the new standard base specifications. Premiums were allowed for higher contents of Cr_2O_3 and a higher chrome:iron ratio; for each additional unit of Cr_2O_3, a premium of $1.10 per long ton was set; for each tenth of a unit increase in the chrome:iron ratio—to a maximum of 3.5:1—an increase of $1.50 per ton was allowed. Penalties were set at $1.10 per unit for each unit of Cr_2O_3 below 48 percent, with the acceptable minimum remaining at 35 percent. For decreases in the chrome : iron ratio below 3:1 there were two schedules; down to 2:1 a penalty of $1.50 per tenth was set, and below 2:1 a deduction was specified of $15.00 per ton with an additional deduction of $1.00 per ton for each tenth down to a minimum, established for the first time, of 1.5:1.

The revised specifications and price schedule were also applied to purchases under the small lot program.

During 1943 only one minor change was made in price regulations affecting chromite. On March 18 the Office of Price Administration removed price ceilings from sales of domestic ore to dealers who buy for resale to the Metals Reserve Co. This exception made available to all small producers the high prices set by the company.

Imported ores continued to be quoted at price ceilings established by the Office of Price Administration. Metallurgical-grade ore of 48 percent Cr_2O_3 and 3:1 chrome : iron ratio was quoted throughout the year at $43.50 per long ton, according to E&MJ Metal and Mineral Markets. The established price ceilings for all grades of chromite were given in Minerals Yearbook, 1942 (p. 633).

UNITED STATES

PRODUCTION IN 1943

Production of chromite (in terms of shipments from mines) in the United States reached 160,120 short tons in 1943, the highest level ever recorded. This record total was attained partly as a result of an increase in prices offered producers by the Metals Reserve Co. but mainly in consequence of the completion of several large operations that had been in a development stage for the greater part of 1942. Production from three Government operations became so large, in fact, that work was halted on all three by the end of the year. Originally planned and developed in the emergency period of 1941 and 1942, their output was too low in quality, although high in tonnage, to be longer needed, as foreign sources of supply were maintained at adequate levels in the face of wartime transportation difficulties.

The average chromic oxide (Cr_2O_3) content was 41 percent, an increase of 2 percent over 1942. The number of individual shippers was the largest on record—175—with 148 in California alone, 21 in Oregon, 4 in Montana, and 1 each in Alaska and Texas.

Chromite production (shipments) in the United States in 1943, by States, in short tons

State	Cr_2O_3, percent			Total
	45 or more	35 to 45	Less than 35	
Alaska		5,569		5.569
California	27,868	33.907	720	62,495
Montana		68,844	6,847	75,691
Oregon	876	15.487		16,363
Texas		2		2
	28.744	123,809	7,567	160,120

An increase in prices and a revision of quality standards by the Metals Reserve Co. brought out a production of approximately 41,000 tons by small operators. Virtually all the metallurgical-grade lump ore was produced by this group; 8,000 tons of this total was lump ore averaging 49 percent Cr_2O_3 content.

No refractory-grade chromite is produced in the United States—virtually all is classified as chemical grade. Consumption reports from chemical producers reveal that the industry uses chromite with an average chromic oxide content of 45 to 50 percent. The major part of domestic production does not meet the normal specifications of any consumer group.

Available geologic information and the requirements of existing industrial practice suggest that domestic deposits of chromite are not important at present in meeting demand, except in a time of national emergency when techniques must be changed, whatever the cost.

Chromite production (shipments) in the United States in 1943, by form of material, percentage of Cr_2O_3, size of individual operation, and ownership of operation (short tons)

	Cr_2O_3, percent			Total
	45 or more	35 to 45	Less than 35	
Form of material:				
Ore	8, 476	29, 646	7, 567	45, 689
Concentrates	20, 268	94, 163		114, 431
Size of individual operation:				
10,000 tons or more	20, 087	92, 592	6, 847	119, 526
Less than 10,000 tons	8, 657	31, 217	720	40, 594
Ownership of operation:				
Federal Government		69, 892		69, 892
Private enterprise	28, 744	53, 917	7, 567	90, 228

There were 169 producers with less than 10,000 tons output for the year; the average production for this group was 240 short tons. Six producers of more than 10,000 tons each—three Government and three private operations—produced nearly 120,000 tons, or 75 percent of all chromite for the year. Nearly all of this total was in the form of concentrates, of which 20,000 tons averaged 45 percent Cr_2O_3, 93,000 tons averaged 40 percent, and 6,100 tons averaged only 31 percent. The 6,100 tons with 31 percent Cr_2O_3 content were virtually the only ore produced by the large operators and were privately sold.

Alaska.—The first production of chromite ever recorded from the Territory of Alaska was made in 1943 by the Chrome Queen Mining Co. from its Red Mountain property on Kenai Peninsula near Seldovia. The deposits have been described by the Geological Survey.[1] Shipments for the year amounted to 5,569 short tons, averaging 41 percent Cr_2O_3 with a chrome: iron ratio of 2.7: 1. Owing to weather conditions, mining operations are possible only from May to early November, and shipments are made in late summer and early fall. Over 2,000 tons of ore have been blocked out for 1944 operations.

California.—The Grey Eagle property of the Rustless Mining Corporation was the largest chromite producer in California for the second successive year; output amounted to 20,087 short tons, an 80-percent increase over 1942. The crude ore averaged about 14 percent Cr_2O_3 and the concentrate over 45 percent Cr_2O_3. However, the property was reported exhausted and shut down in February 1944. The geology of the deposit has been described by Allen[2]; details of the mill and mining operations have also been published.[3]

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[1] Guild, Philip W., and Balsley, J. R., Jr., Chromite Deposits of Red Bluff Bay and Vicinity, Baranoff Island: Geol. Survey Bull. 936-G, 1942, pp. 171-187.

The second largest chromite producer in California was the Castro group of mines in San Luis Obispo County, operated by the Castro Chrome Associates, Inc. The mill is at Goldtree Siding and began operations in 1942. The ore has consistently averaged 20 percent and the concentrates 42 percent Cr_2O_3, with a chrome:iron ratio of 2.5 : 1. Production in 1943 amounted to 12,553 short tons, more than double the 1942 total. The Bureau of Mines and the Geological Survey have explored the Castro and nearby deposits.[4]

Montana.—Production from Montana properties during 1943 amounted to 75,691 short tons, the largest total recorded from one State since California supplied 70,725 short tons in 1918. Only the cancellation of operations in the Stillwater complex in September by the Metals Reserve Co. prevented the State from establishing an even higher record.

The output of the 400-ton Benbow mill, established in 1942, was supplemented by a new 1,000-ton mill at the Mouat-Sampson properties, which began operation in May 1943. The mill output at Benbow amounted to 28,437 short tons of chromite with a Cr_2O_3 content of 41.45 percent and iron of 22.6 percent. The crude ore averaged 18.34 percent. At Mouat-Sampson the output was 29,538 short tons, averaging 38.8 percent Cr_2O_3 and 24.7 percent iron. The crude ore averaged 19.26 percent Cr_2O_3. At both mills considerable quantities of crude ore remained to be processed at the time of closing down.

The North Star group in Carbon County, operated by the United States Vanadium Corporation, also shipped considerable quantities of chromite during the year. More than half the shipments were in the form of concentrates, averaging about 36 percent Cr_2O_3; the remainder was low-grade crude ore averaging 31 percent Cr_2O_3.

Oregon.—The output of Defense Plant Corporation at Coquille, which treated beach-sand concentrates, was the only large tonnage contributed by an individual operation.

Oregon beach sands.—The deposits are scattered along the Pacific coast of Coos and Curry Counties from Port Orford on the south to Marshfield on the north; they may be situated anywhere from within 1 mile to 3 miles from the shore line. These beach placers were discovered in 1852 and were originally worked for their gold content. After an initial period of intensive activity the deposits were worked only spasmodically. The presence of chromite in the sands has been known for many years, but not until 1941[5] was systematic exploration started to outline the deposits and determine their grade.

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[2] Allen, J. E., Geological Investigation of the Chromite Deposits of California: California Jour. Mines and Geol., vol. 37, No. 1, January 1941, pp. 133-134.

[3] Huttl, J. B., California's Chromite Assumes New Importance: Eng. and Min. Jour., vol. 143, No. 10 October 1942, pp. 43-46.

Mining World, California Chrome—Rustless Iron & Steel Corporation's Grey Eagle Mine: Vol. 4, No. 8, August 1942, pp. 3-8.

[4] Department of Interior Information Service, Chromite Deposits near San Luis Obispo, Calif.: Press Notice 8533, December 1942, 2 pp.

The geology of the area has been discussed by Pardee.[6] Concentrations of black sand containing chromite, magnetite, ilmenite, and other heavy material were formed by wave action along the old beaches and offshore benches. The coast was subsequently elevated and the shore line receded, leaving the deposits 170 to 400 feet above the shore line and 1 mile to 3 miles inland.

The sands occur as flat-lying strata ranging in thickness from 1 foot to 35 feet. They are generally elliptical, although some are quite irregular. In places where they have been left intact from erosion, they are 1,000 to 2,000 feet long and 100 to 500 feet wide. The greatest thickness and the best grade of material are generally near the center of the deposit; toward the edges the strata feather out and decrease in grade. Overburden consists of barren marine sands, topsoil, and clay and ranges from 1 foot to 20 feet in thickness.

Developed reserves in early 1943 amounted to 1,500,000 tons, with another 1,200,000 considered probable. The material as mined ranged from 5 to 10 percent Cr_2O_3 content, with the average slightly above 6 percent. Primary concentration was by tabling or jigging, with tabling preferred, and produced a concentrate ranging from 20 to 25 percent Cr_2O_3, a ratio of concentration of 5:1.

The Humphreys Gold Corporation developed a gravity concentration device, called the "Humphrey's spiral," which has attracted considerable attention.[7] With a capacity of 840 short tons of sands a day, the company processed an estimated 240,000 short tons of sand from May 13 to December 6, 1943, when the plant was closed as a result of contract cancellation by the Metals Reserve Co. A total of 47,667 short tons of concentrates was produced during this period, with an average of 25.09 percent Cr_2O_3.

The Krome Corporation worked the largest deposit[8] and with a daily mill capacity of 1,120 short tons processed 260,930 short tons of sand and produced 40,173 short tons of concentrates averaging 24.05 percent Cr_2O_3.

The output of both Humphreys Gold Mining and Krome Corporation was shipped to a special plant erected at Coquille, Oreg., by the Defense Plant Corporation and operated for the Government by the Southwestern Engineering Co. Secondary concentration at this plant resulted in an output of 11,918 short tons of chromite averaging 39.3 percent Cr_2O_3, with a chrome:iron ratio of approximately 1.6:1. Operations were halted in December at the order of the Metals Reserve Co., and the plant was placed in stand-by condition. Considerable stocks of primary concentrates remain on hand awaiting future disposition.

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[5] The Ore Bin, Oregon State Department of Geology and Mineral Industries: Vol. 4, No. 1, January 1942, pp. 1-8.

[6] Pardee, J. T., Beach Placers of the Oregon Coast: Geol. Survey Circ. 8, 1934, 41 pp.

[7] Huttl, J. B., New-Type Concentrator Cuts Chromite Dressing Costs: Eng. and Min. Jour., vol. 144, No. 10, October 1943, pp. 68-70.

Mining World, Spiral Gravity Concentration: Vol. 5, No. 10, October 1943, pp. 10-13.

[8] Mining World, How Krome Corporation Worked the Black Sand Deposits of the Oregon Coast: Vol. 6, No. 1, January 1944, pp. 7-12.

EXPLORATION AND DEVELOPMENT

The record domestic production of 1943 was the culmination of the exploration and development done in the previous 2 years by private enterprise and Federal agencies. The Mouat-Sampson deposit in Stillwater County, Mont., and the beach sands in Coos and Curry Counties, Oreg., reached the production stage and contributed a large share of the year's total output.

The details of the Mouat-Sampson project and its companion operation at Benbow have been described previously. The Oregon beach sands were the subject of the largest development done in 1943. The Bureau of Mines completed its work on test-drilling the area, and extensive experiments were carried out to improve the Cr_2O_3 content and increase the chrome:iron ratio. A report on this work is expected to be published in the near future.

Other work was done by the Bureau in Georgia and California, but very small tonnages were proved. Work on the Red Mountain deposit on Kenai Peninsula in Alaska was continued and a confidential report prepared.

The Geological Survey completed field work on chromite deposits in the Red Lodge and Stillwater districts of Montana and the beach sands of Oregon. The Survey estimated that 20,000,000 tons of low-grade chromite are available in the Stillwater complex. Geologists of the Survey cooperated with the Bureau of Mines in examining the McCormick mine in California. Many other small deposits in the Pacific States were explored. The Red Mountain deposit in Alaska was also reexamined after the Chrome Queen Mining Co. had done considerable mining and development. The exposures thus made accessible were interpreted by Survey representatives.

During the year the Geological Survey released geologic descriptions and maps of the following properties: The High Plateau and Little Castle Creek deposits in California; the Red Lodge and Silver Star deposits in Montana; the Twin Sisters Mountains deposit in Washington; and the Camaguey Province deposits of Cuba. The last project was in cooperation with the Cuban Government.

HISTORICAL SURVEY OF SUPPLY

The relative growth of the total supply of chromite and the proportion of domestic production to total supply are given below. Averages of 5-year periods were used, and the World War I period, 1916–20, was taken as 100 percent. Other periods were related to this base period upon a percentage basis. In addition, the actual percentage of domestic production in the total supply is given.

Comparison of relative changes in total supply and domestic production, 1891–1943, and relation of domestic production to total supply, in percent

Period	Total supply	Domestic production	
	Relatives	Relatives	Percent of total supply
1891-95	5	5.0	28.5
1896-00	10	.5	1.3
1901-05	24	.5	.6
1906-10	28	.9	.8
1911-15	46	2.0	1.4
1916-20	100	100.0	26.5
1921-25	84	.7	.2
1926-30	191	.7	.1
1931-35	128	1.0	.2
1936-40	325	.5	.04
1941-43	724	236.0	8.7

The use of 1916–20 as a base allows an illustration of the growth in the supply (and demand) of chromite between the First and Second World Wars. Total supply for World War II is over seven times greater than in World War I. Another feature deserves comment: Domestic production in 1941–43 is more than twice as great as in the World War I period, but its relationship to total supply has declined from 26.5 percent to 8.7. In peacetime years domestic production is a negligible factor in supply.

CONSUMPTION

The consumption of chromite reached an all-time high in 1943; the total was 964,600 short tons, an 8-percent gain over 1942. The increase took place almost entirely in the consumption of metallurgical-grade material.

In assembling the data it was necessary to define grades in terms of consumer groups having known end products. Thus in the table the data for metallurgical chromite are actually the total consumption by producers of ferrochromium and other chromium-containing metal products rather than a definition set by rigid chemical analyses. Similar standards were applied in the refractory and chemical groups.

Consumption of chromite in the United States, in short tons, and average quality of chromite consumed by primary consumer groups, 1940–43

	Total consumption (short tons)	Average Cr_2O_3 contained, by primary consumer groups (in percent)		
		Metallurgical	Refractory	Chemical
1940	562,915	50.5	35.8	47.2
1941	800,290	50.1	34.8	46.3
1942	891,952	48.5	34.0	44.8
1943	964.600	48.5	34.0	44.7

A feature to be noted in the data is the degradation of material consumed in terms of chromic oxide contained, which was brought about largely by the desire of the War Production Board to lower standards to basic essentials, thus preventing overconsumption as to quality and at the same time conserving the national stock position. The development of National Emergency alloy steels, with lower chromium contents than normal peacetime alloy steels, effected a considerable saving in metallurgical chromite. This subject was discussed in a series of 13 papers by Gillett.[9] The debasing of consumed chromite reached its lowest levels in the second and third quarters of 1942, when Axis obstruction of shipping lanes was at a peak. Since then an improvement in shipping has resulted in slight relaxation of the degradation process.

The 114-percent increase in consumption by metallurgical users from 1940 to 1943 is a striking commentary on the war program. Consumption by refractory users increased 45 percent from 1940 to 1943.

Chemical-industry consumption of chromite has been relatively stable since 1940 upon a tonnage basis—the gains of the other two groups were not paralleled by the chemical group, as its proportional share of the total consumed declined from 20.9 to 13.0 percent. Inability to expand manufacturing capacity rapidly was the chief cause of the chemical industry's relative decline; in 1943 the supply of chrome chemicals became so tight that the War Production Board was forced to place them under allocation.

Of outstanding significance for the future has been the increased consumption of chromium metal. Domestic consumption has increased greatly since 1939. The demand for chromium metal is now supplied entirely from domestic manufacture, whereas before 1939 the material was supplied largely by Germany, Norway, and the United Kingdom.

IMPORTS AND EXPORTS[10]

Imports of chromite in 1943 declined for the second successive year from the high of 1941 but were at a level high enough to maintain a good supply condition. The total of 928,576 tons of all grades was a decline of 5 percent from 1942 and 17 percent from 1941.

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[9] Gillett, H. W., An Engineering Approach to the Selection, Evaluation, and Specification of Metallic Materials: Steel, vol. 113, No. 21, November 22, 1943, to vol. 114, No. 7, February 14, 1944.

[10] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Imports of chromite into the United States, 1939–43, by continents and countries of origin

	Gross weight (short tons)				1943		
	1939	1940	1941	1942	Short tons		Value
					Gross weight	Cr_2O_3 content	
Africa:[1]							
Sierra Leone	6,272	15,568	16,464				
Southern Rhodesia	54,599	177,909	269,210	277,272	243,508	116,718	$3,855,797
Union of South Africa	71,550	126,349	189,703	262,259	111,602	50,340	1,068,507
Total	132,421	319,826	475,377	539,531	355,110	167,058	4,924,304
Asia:							
India	18,444	36,561	10,910	21,316	2,800	1,372	68,112
Philippine Islands	80,544	175,354	288,411	30,475			
Turkey	18,628	78,491	61,845	[3] 119,548	90,778	42,363	2,181,244
Total	117,616	290,406	361,166	171,339	93,578	43,735	2,249,356
Europe:							
Cyprus					8,400	3,729	176,250
Greece	12,320	15,726	2,199				
U. S. S. R.				30,061	99,922	48,227	4,162,221
Yugoslavia	1,120	1,120					
Total	13,440	16,846	2,199	30,061	108,322	51,956	4,338,471
North America:							
Canada	1	209	393	13,705	17,046	8,016	678,818
Cuba	73,922	58,190	179,944	137,826	310,729	112,554	3,591,502
Guatemala	2,130				2,001	988	100,000
Total	76,053	58,399	180,337	151,531	329,776	121,558	4,370,320
Oceania: New Caledonia[2]	16,082	48,010	90,208	[3] 82,677	32,505	15,821	399,950
South America: Brazil		3,125	6,005	6,468	9,285	4,233	150,110
Total imports	355,612	736,612	1,115,292	[3] 981,607	928,576	404,361	16,432,511

[1] See note below.

[2] Listed as French Oceania by U. S. Department of Commerce.

[3] Revised.

NOTE.—For the first time the countries of origin in Africa are identified in this table. This required arbitrary assignments of certain tonnages to overcome limitations of official information on imports.

Of the countries grouped under "Other British West Africa" by the U. S. Department of Commerce only Sierra Leone is a known source of chromite; therefore a substitution of names has been made by the Bureau of Mines in reproducing the data.

Before 1942 Southern Rhodesia was included in the group title "Other British South Africa." As the only other South African source—the Union of South Africa—has been regularly identified and credited with the tonnages it supplied, it was decided to allocate imports under the heading of "Other British South Africa" to Southern Rhodesia.

Two other adjustments were necessary in regard to Southern Rhodesia. In 1941 and 1942 Mozambique was credited as the source of imports of 15,624 tons and 11,319 tons, respectively. Mozambique is not a source of chromite, except as a shipping point. Therefore, taking cognizance of the chemical analyses of the chromite in question and with the knowledge that chromite from the Union of South Africa has been regularly assigned—even though this chromite moves through Mozambique for the most part—it was decided to allocate these two tonnages to Southern Rhodesia as the most probable source.

One further adjustment was necessary. In 1942 Anglo-Egyptian Sudan was credited by the U. S. Department of Commerce as the source of 2,152 tons of chromite. Such a source is most unlikely, according to other available information. Shipping facilities in the eastern Mediterranean were subject to war-caused disruptions at the time, and a review of other information suggested that this tonnage probably originated in Turkey. It has been so allocated in the table.

These revisions are by the authors.

Ferrochromium imports in 1943 were from Canada only and amounted to 10 short tons of grades containing 3 percent or more carbon and 305 tons of grades with less than 3 percent carbon. Import figures on ferrochromium for 1942 have been revised, although the total is still from Canada; the total in 1942 for grades containing 3 percent or more carbon was 5 short tons, with 377 tons of grades containing less than 3 percent carbon. It is believed that all imports from Canada are entirely of a material known in trade circles as Chrom-X,[11] a patented product developed by a Canadian company to utilize low-grade ores to produce a material similar to standard ferrochromium.[12]

Exports of chromite in 1943 amounted to 26,259 short tons, the highest total ever recorded and a gain of over 450 percent from the previous year. The largest total for an individual country was 22,226 short tons exported to Canada, followed by 3,955 tons to the United Kingdom. The remainder of the exports was entirely to South American countries and the Canal Zone.

Ferrochromium exports amounted to 2,360 short tons, of which the greater part went to the U. S. S. R.; Australia received the second largest quantity.

WORLD PRODUCTION

World production of chromite, 1939–43, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1939	1940	1941	1942	1943
Africa:					
Egypt					910
Sierra Leone	10,755	17,777	(1)	[2] 15,000	[2] 12,500
Southern Rhodesia	139,083	(1)	[2] 322,000	[2] 335,000	[2] 310,000
Union of South Africa	160,014	163,646	141,884	337,620	163,232
Asia:					
Cyprus	(1)	4,775	(1)	[2] 5,000	[2] 7,500
India	49,925	(1)	(1)	[2] 40,000	[2] 50,000
Japan	(1)	(1)	(1)	(3)	(3)
Philippine Islands (exports)	126,749	194,393	[2] 300,000	[2] 50,000	[2] 60,000
Syria and Lebanon	(1)	(1)	(1)	(3)	(3)
Turkey	191,644	[6] 110,037	[2] 100,000	144,700	[2] 150,000
U. S. S. R.	(1)	(1)	(1)	[4] 400,000	[2] 325,000
Europe:					
Albania	3,070	[2] 14,000	[4] 20,000	[2] 5,000	[2] 5,000
Bulgaria	4,251	6,000	(1)	[2] 6,500	[2] 7,000
Greece	57,091	[5] 33,118	(1)	[2] 40,000	[2] 50,000
Norway	371	(1)	(1)	(3)	(3)
United Kingdom (shipments)	(1)	[2] 1,200	(1)	[2] 500	[2] 500
Yugoslavia	59,527	71,019	(1)	[2] 100,000	[2] 65,000
North America:					
Canada	1	304	2,152	10,393	27,293
Cuba	59,562	52,347	163,175	286,470	354,152
Guatemala	564	136	697	529	374
Mexico	(1)	(1)	12	17	
United States	3,672	2,705	12,935	102,400	145,258
Oceania:					
Australia: New South Wales	108	508	356	[2] 610	[2] 700
New Caledonia	52,000	55,790	[2] 45,720	[2] 71,120	[2] 50,000
South America:					
Argentina			60	200	[2] 250
Brazil (exports)	3,554	4,572	5,944	5,776	7,813
Total world production	[2] 1,167,000	[2] 1,300,000	[2] 1,750,000	[2] 1,956,835	[2] 1,777,032

[1] Estimate included in total.
[2] Estimated by authors.
[3] Data not available.
[4] Planned production.
[5] May include some production in Yugoslavia.
[6] Exports.

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[11] Udy, Marvin J., Chrom-X and Our Chromium Problem: Metals and Alloys, vol. 14, No. 7, July 1941, pp. 52–55.

[12] McDonald, J. H., Use of Chrom-X in Steel Making: Metals and Alloys, vol. 15, No. 2, February 1942 p. 249–253.

Albania.—The largest chrome mines in Albania—all surface operation—are in the vicinity of Kukes and Kruma in the northeastern section of the country and near Pogradec Cedilla on the western shores of Lake Ochrida. It is reported that the ore has a 50 percent Cr_2O_3 content. Another chrome mine was being operated near the town of Prishtina in the new Kossovo district, that is, in the territory that was Yugoslav until 1941 and had been occupied by the Italian forces. It is stated that during the war all the Italian chrome requirements were supplied from the mines in the Kossovo district. Part of the ore extracted from these mines was also shipped to Germany.

Canada.[13]—The leading chromite producer in Canada during 1943 was the old Reed-Belanger property—now known as Chromeraine and operated by the Wartime Metals Corporation, Canadian counterpart of the Metals Reserve Co. in the United States—located near Black Lake. The St. Cyr [14] deposit near Richmond—known in World War I as the Sterrett mine—which is now operated by Chromite, Ltd., was the second largest producer. Both operations are in the Eastern townships of Quebec Province.

At Chromeraine an extensive program of drilling and underground investigations indicated that over a million tons of milling-grade ore were available, and a 600-ton mill was erected in the spring. The mill is reported to be doing custom milling for many smaller operators.

At the St. Cyr deposit favorable indications prompted the erection of a mill of 100 tons capacity in 1941; it was increased to 150 tons in late 1942.

The Bird River discovery in Manitoba continued to be the subject of considerable field work and laboratory testing. J. D. Bateman [15] has described the deposits. Many operators have staked claims, and several companies have acquired large holdings through purchases and leases of claims from others. At the end of 1943 little work was being done pending the results of extensive laboratory work designed to increase the chrome:iron ratio of the ore above 1.2:1. Uncertainty regarding the future of the Government purchasing program also deterred actual operations.

Cuba.—Production of refractory-grade chromite tapered off in the last quarter of 1943 as contracts expired. New contracts for 1944 were said to involve a smaller quantity of ore than in 1943, with maximum expected production about 65 to 75 percent of 1943. Many smaller mines were worked out, and prospecting and development declined to a low point as a result of the lower demand. Shipping stocks and ore reserves were still at a high level, however.

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[13] Bureau of Mines, Dept. of Mines and Resources, Ottawa, Canada, March 1943. Northern Miner, vol. 29, Nos. 13 and 16, 1943.

[14] See footnote 13.

[15] Bateman, J. D., Bird River Chromite Deposits, Manitoba: Canadian Min. and Met. Bull., Trans., vol. 46, No. 374, June 1943, pp. 154-183.

Japan.—Large new veins of chrome ore, reportedly averaging 50 percent metal content, have been discovered by a field party exploring in the Sarugun district, Hokkaido, according to a Japanese radio announcement.[16]

North and South America.—Results are given of 52 complete and 144 partial analyses of chromite from deposits in Alaska, Canada, Mexico, Cuba, Guatemala, Venezuela, Colombia, Brazil, and the United States. The analyses show, in general, the grade of chromite at the various localities studied, and the complete analyses are used to interpret isomorphism in chromites. The study was made as a part of the strategic minerals program conducted by the Geological Survey and the Bureau of Mines.[17]

Southern Rhodesia.[18]—A description has been given of a concentrator erected to treat the rejected material obtained after lumpy metallurgical ore was sorted at the Railway Block mine, Selukwe, Southern Rhodesia. The mill has a capacity of 120 long tons per 24 hours and is said to produce clean, small metallurgical-grade ore, as well as chemical-grade concentrates. The mill feed for the whole plant averages 36 percent Cr_2O_3, and for the gravity plant 40 percent Cr_2O_3; recoveries average 75 percent in the mill and 70 percent in the gravity plant. Three Europeans and 160 natives—including 110 sorters—are employed.

Turkey.—Preliminary estimates show that in 1943 Turkey exported 56,000 metric tons of chromite to the United Nations and 47,000 tons to Germany. During the first 2 months of 1944 Germany is said to have received 14,800 tons, but only 1,870 tons went to the United States. All exports of chromite to Germany under the Claudius agreement were said to have been halted after February 1944.

Union of South Africa.[19]—The new plant of Marble, Lime & Associated Industries, Ltd., for the manufacture of chrome chemicals in South Africa has been completed. Since the capacity of the new factory now exceeds domestic requirements, an export trade has been started.

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[16] Foreign Commerce Weekly, vol. 13, No. 8, November 20, 1943, p. 27.

[17] Stevens, Rollin E., Composition of Some Chromites of the Western Hemisphere, U. S. Geol. Survey: Am. Mineral., vol. 29, Nos. 1 and 2, January and February 1944, pp. 1–34.

[18] Brooke-Howard, W., Chrome Concentrator at Selukwe: Bull. Inst. Min. and Met., No. 462, September 1943, 6 pp.

[19] Chemical and Metallurgical Engineering, vol. 50, No. 3, March 1943, p. 187.

NICKEL

By H. W. Davis

SUMMARY OUTLINE

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SUMMARY

Shifts in military demands and greater use of low-alloy as compared with high-alloy steels prevented a shortage of nickel in 1943. Nevertheless, the consumption of primary nickel was about 6 percent greater than in 1942. Imports of nickel in all forms exceeded those in the previous peak year 1942 by 7 percent. A substantial saving in nickel was accomplished by the use of NE steels, which contain 0.2 to 0.7 percent nickel, and by the recovery of nickel scrap. According to Work:[1]

> In 1943 approximately one-third of the alloy steels produced were NE steels, a step that is credited with saving 24,000 tons of nickel at a small cost in manganese and molybdenum. Another 10,000 tons of nickel was saved by careful attention to the recovery of the residual alloys in scrap. This has been accomplished by the vigilant segregation and re-use of alloy scrap despite the fact that scrap with two or three alloy components is presenting considerable difficulty.

As insufficient labor was available to operate the expanded mine and plant capacity, the production of nickel in Canada in 1943 was only slightly more than in 1942. Production in New Caledonia, the second-largest producing country, declined substantially. The new plant of the Nicaro Nickel Co. in Cuba made its initial output of nickel oxide in December 1943.

Salient statistics for nickel, 1939–43

	1939	1940	1941	1942	1943
United States:					
Production:					
Primary .... short tons	394	554	660	[1] 612	642
Secondary .... do	2,920	4,152	5,315	4.142	(2)
Imports (gross weight) [3] .... do	64,796	92,468	124,130	132,954	141,249
Exports (gross weight) [4] .... do	10,167	11,994	7,125	7,096	9,464
Price per pound [5] .... cents	35	35	35	35	35
Canada:					
Production .... short tons	113,053	122,779	141,129	142,606	143,882
Imports .... do	697	(2)	(2)	(2)	(2)
Exports .... do	117,391	(2)	(2)	(2)	(2)
World production (approximate) .... do	134,000	154.000	179,000	182,000	172,000

[1] Revised figure.
[2] Figures not yet available.
[3] Excludes "All other manufactures of nickel"; weight not recorded.
[4] Excludes "Manufactures"; weight not recorded.
[5] Price quoted by International Nickel Co. of Canada, Ltd., for electrolytic nickel at New York, in 2-ton minimum lots.

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[1] Work, H. K., Steelmaking: Metals and Alloys, vol. 19, No. 1, January 1944, p. 69.

As heretofore, the domestic output of primary nickel was insignificant in 1943.

The St. Louis Smelting & Refining Co. continued development at its properties near Fredericktown, Mo., where nickel and cobalt occur with lead, copper, and iron. A mill was under construction.

The new cobalt-nickel plant of the Ferro Enamel Supply Co., Cleveland, Ohio, began operating in September 1943 on Burmese speiss, which contains about 30 percent nickel, 7 percent cobalt, 40 percent arsenic, and 10 percent copper.

A process for separating nickel and cobalt in solutions is the subject of United States Patent 2,290,313.

Possible new sources of nickel were discussed by Pawel.[2]

POST-WAR OUTLOOK

The post-war outlook for nickel has been ably discussed in Engineering and Mining Journal,[3] as follows:

> Nickel will come out of its Second World War experience with a much more favorable post-war outlook than it enjoyed 25 years ago. At that time it had the dubious reputation of being primarily a munitions metal; but in the interim it has found such extensive industrial uses that producers can now look forward to supplying well-established peacetime markets. Consumption of the metal will naturally recede from it wartime peak. But when restrictions on use are removed, there is likely to be an extraordinary demand to satisfy the pent-up industrial market. Thereafter, production and consumption will revert to a more normal state. The increased use of nickel in war applications is likely to be reflected in peacetime demand, and some new uses will appear that cannot now be revealed.
>
> With a few exceptions the pattern of post-war nickel consumption will not differ greatly from that of pre-war. It is in the variety of nickel alloys that the largest consumption occurs. Alloy steels head the list and may account for two-thirds of total consumption. Best known are the stainless steels. Although the development trend has been toward lower nickel content in alloy steels, it is nevertheless believed that the markets for nickel alloy steels have been broadened and will result in an increased consumption of nickel.
>
> The increasing use of high-temperature industrial processes will afford an expanding market for nickel-alloy steels. Nickel cast irons also are growing in favor where abrasion resistance is desired. Nickel plating is a field that is likely to expand, and nickel-clad metals will probably grow in favor. Alloys of nickel and the nonferrous metals will doubtless show substantial growth. In short, the post-war outlook for nickel can be regarded as favorable.

WAR REGULATIONS

Distribution of Canadian nickel matte and metal is controlled by the Canadian Government, but in accordance with recommendations of the Combined Raw Materials Board. Distribution of primary nickel and secondary nickel (except nickel contained in iron and steel scrap) in the United States is under complete allocation (General Preference Order M–6–a through c, as amended). The quantity of matte used to make Monel metal is determined quarterly by the Combined Raw Materials Board. All nickel-control programs are effected largely through the International Nickel Co., the major operator in Canada and the United States, which also refines the matte received from New Caledonia. By Order M–21–a the War Production Board controls the proportions of alloying elements, including nickel, that may be used in making alloy iron and steel.

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[2] Pawel, G. W., Possible New Sources of Nickel: Min. and Met., vol. 24, No. 438, June 1943, pp. 277-278.

[3] Engineering and Mining Journal, Metals for the Alloy Steels: Vol. 145, No. 2, February 1944, p. 84.

PRODUCTION

Domestic production of nickel is small and comprises secondary metals recovered from scrap-nickel anodes, nickel silver, and copper-nickel alloys (including Monel metal), and primary metal recovered in copper refining and produced from ore and as a byproduct of talc production, as listed in the following table. Domestic primary nickel was recovered in 1943 as a byproduct in copper refining at Baltimore, Md., Laurel Hill, N. Y., Perth Amboy, N. J., and Tacoma, Wash. Concentrates containing 10 percent nickel and 0.7 percent cobalt were recovered as a byproduct of talc production in Vermont; however, none was shipped.

Nickel produced in the United States, 1939–43

Year	Primary (short tons)[1]		Secondary[2]	
	Byproduct in copper refining[3]	Other[4]	Short tons	Value
1939	394		2,920	$2,044,000
1940	554		4,152	2,906,400
1941	619	41	5,315	3,720,500
1942	[5] 612		4,142	2,899,400
1943	642		(6)	(6)

[1] Bureau of Mines not at liberty to publish value.
[2] Nickel recovered as metal and in alloys and salts.
[3] Nickel content of nickel salts and metallic nickel.
[4] Nickel content of matte produced from ore and of concentrates produced as byproduct of talc.
[5] Revised figure.
[6] Figures not yet available; they will be found in chapter on Secondary Metals—Nonferrous.

FOREIGN TRADE[4]

The nickel imported into the United States in 1943 established a new peak and was 7 percent greater than in 1942, the previous record year. Imports comprised chiefly metallic nickel, matte, and oxide. As heretofore, Canada was the chief source of the imports; it supplied 184,265,773 pounds of metallic nickel, 70,271,479 pounds of matte, and 10,267,463 pounds of oxide. Most of the matte from Canada contained 54 to 55 percent nickel and 25 percent copper and was refined to Monel metal and other products at the plant of the International Nickel Co., Inc., at Huntington, W. Va. Some roasted matte containing about 75 percent nickel was received from Canada in 1943; and it, with virtually all of the oxide, was refined to nickel at Huntington. About 7,200 short tons of nickel were produced at Huntington from Canadian materials in 1943. During the year 2,297,994 pounds of electrolytic nickel were received in the United States from French Morocco; of this quantity, 1,459,705 pounds were classified by the United States Department of Commerce as "ore and matte." This metal was originally produced in Canada. New Caledonia supplied 14,257,847 pounds of matte; it contains about 78 percent nickel and is also refined at Huntington. About 5,200 short tons of nickel were produced from New Caledonian matte in 1943. Brazil and Cuba furnished 665,379 and 317,049 pounds, respectively, of ore in 1943. The Brazilian ore was shipped to Perth

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[4] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Amboy, N. J., where the American Smelting & Refining Co. is testing its treatment process upon this ore in a pilot plant. The United Kingdom supplied 100,757 pounds of oxide and 52,830 pounds of metallic nickel in 1943.

The nickel content of the unmanufactured nickel products imported into the United States is estimated at 244,983,000 pounds in 1943 compared with 228,550,000 pounds in 1942.

Exports of nickel comprise largely products manufactured from imported raw materials. Exports of alloys (including Monel metal) and scrap were 25 percent greater in 1943 than in 1942, and exports of metallic nickel were 54 percent larger. Exports of nickel-chrome electric resistance wire declined 10 percent. The United Kingdom (10,292,752 pounds), U. S. S. R. (6,020,709 pounds), and Canada (1,155,888 pounds) were the chief markets for nickel, Monel metal, alloys, and scrap in 1943.

Nickel (excluding residues) imported for consumption in the United States, 1941–43, by classes

Class	1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured:						
Nickel ore and matte	79,892,400	$11,267,845	80,378,120	$11,934,409	86,971,459	$13,017,158
Nickel pigs, ingots, shot, etc	149,466,723	37,429,028	161,202,200	40,588,948	184,042,404	46,272,805
Nickel bars, rods, tubes, etc	520,199	227,319	372,930	174,511	1,114,488	351,956
Nickel oxide	18,377,937	3,039,026	23,954,909	3,982,877	10,368,220	1,842,114
Manufactured:						
Nickel silver or German silver in sheets, strips, rods, and wire	2,800	2,545	----------	----------	1,017	273
All other manufactures of nickel	(1)	1,785	(1)	57,478	(1)	1,493
	----------	51,967,548	----------	56,738,223	----------	61,485,799

[1] Quantity not recorded.

Nickel exported from the United States, 1941–43, by classes

Class	1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value
Ore, concentrates, and matte	12,190,549	$4,608,139	104	$92	145,090	$86,762
Alloys and scrap containing nickel (including Monel metal)			8,996,413	3,472,575	11,266,777	3,898,669
Metal in ingots, bars, sheets, etc			4,251,948	1,947,597	6,559,228	3,006,809
Manufactures	(1)	863,011	(1)	420,294	(1)	1,029,966
Nickel-chrome electric resistance wire	336,123	381,927	668,194	792,255	598,059	846,221
Nickel silver or German silver, crude, scrap, or bars, rods, etc	1,694,800	359,732	155,282	94,568	182,625	127,588
Nickel salts and compounds	[2] 28,363	[2] 10,104	119,971	46,417	176,820	67,676
	----------	6,222,913	----------	6,773,793	----------	9,063,691

[1] Quantity not recorded.
[2] Figures cover September to December; not separately classified before Sept. 1, 1941.

WORLD PRODUCTION

Because of restriction on the publication of statistics by many governments, few figures have become available since 1939.

World production of nickel (content of ore), 1937–43, by countries, in metric tons[1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Australia	....	20	....	(2)	(2)	(2)	(2)
Brazil	104	375	25	(2)	(2)	(2)	(2)
Burma	1,233	959	921	(2)	(2)	(2)	(2)
Canada	[3] 102,015	95,514	102,559	111,383	128,029	129,369	130,527
Egypt	14	33	(2)	(2)	(2)	(2)	(2)
Germany	890	550	(2)	(2)	(2)	(2)	(2)
Greece	957	1,207	1,336	(2)	(2)	(2)	(2)
Italy	68	[4] 150	(2)	(2)	(2)	(2)	(2)
Morocco, French	132	163	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	....	[4] 500	[4] 753	2,222	(2)	(2)	(2)
New Caledonia	11,600	11,700	10,625	10,535	10,395	9,415	5,408
Norway	877	1,245	1,106	(2)	(2)	(2)	(2)
Southern Rhodesia	4	76	[4] 490	(2)	(2)	(2)	(2)
Union of South Africa	....	44	398	416	(2)	(2)	(2)
U. S. S. R.	2,000	2,500	(2)	8,650	(2)	(2)	(2)
United States [5]	199	377	357	503	599	[6] 555	582
	120,100	115,500	[4] 122,000	[4] 140,000	[4] 162,000	[4] 165,000	[4] 156,000

[1] In addition to countries listed, Cuba, Finland, Japan, and Sweden produce nickel, but data of output are not available.

[2] Data not yet available; estimate included in total.

[3] Excludes small quantity produced in British Columbia.

[4] Estimate.

[5] Byproduct in electrolytic refining of copper. In 1941 includes also small quantities produced from ore and as byproduct of talc.

[6] Revised figure.

Brazil.—At the Tocantins nickel deposit, in the State of Goyaz, in which the American Smelting & Refining Co. has a 50-percent share interest, no actual development was done during 1943, as it first requires the construction of a good truck road from Anapolis at the railhead into the property, a distance of about 155 miles. Late in 1943 the Brazilian Government authorized construction of the road, and work thereon was to have been started early in 1944. To thoroughly test its treatment process upon the ore, the American Smelting & Refining Co. shipped about 500 tons of average Tocantins nickel ore and constructed at its Perth Amboy (N. J.) works a pilot plant of 5 tons daily capacity. The pilot plant has been operating upon this ore since the fall of 1943, and is continuing to do so. Work is also proceeding upon the construction of a warehouse, an administration building, and a transit house at the railhead at Anapolis.

Canada.—Virtually all the Canadian output is derived from copper-nickel ores of the Sudbury district, Ontario. Some nickel is also recovered as a byproduct from silver-cobalt ores of Cobalt and other areas in northern Ontario. Two companies—International Nickel Co. of Canada, Ltd., and Falconbridge Nickel Mines, Ltd.—are the principal producers. Production in Canada was 143,882 short tons in 1943 compared with 142,606 tons in 1942.

According to the International Nickel Co. of Canada, Ltd.:[5]

> Deliveries of nickel in all forms derived from our own mine production amounted in 1943 to 265,000,000 pounds, representing an increase of 55,000,000 pounds over 1939. In order to provide this enlarged supply, the tonnage of our ore mined was

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[5] International Nickel Co. of Canada, Ltd., Annual Report: 1943, p. 4.

forced from 7,273,000 tons in 1939 to 12,105,000 tons in 1943. Had it not been for shortage of manpower during the last 6 months of the year the production would have been appreciably higher. As an emergency war measure we have also refined a volume of nickel originating from the mines of others. Our own deliveries, together with this volume refined for others, totaled nearly 300,000,000 pounds.

Tonnage of ore hoisted and of metals produced by Falconbridge Nickel Mines, Ltd.,[6] in 1943 was substantially higher than that recorded for any previous year. Ore treated in 1943 totaled 807,048 short tons (771,619 tons in 1942) and comprised 514,724 tons of milling ore and 292,324 tons of smelting ore. The ore treated averaged 1.62 percent nickel in 1943 (1.60 percent in 1942). Matte produced in 1943 contained 11,597 tons of nickel (10,789 tons in 1942). Ore reserves were 12,289,000 tons averaging 1.74 percent nickel on December 31, 1943. A new second blast furnace was started in March 1943.

In 1943 copper-nickel ore was shipped to the International Nickel Co. of Canada, Ltd., from the Moose mine of the Ontario Nickel Corporation, the Harlin (formerly Alexo) mine of Clifton Consolidated Mines, Ltd., and a property of Nickel Offsets, Ltd.

Cuba.—Construction of the plants for the production of nickel which the Nicaro Nickel Co., a subsidiary of the Freeport Sulphur Co., undertook for the United States Government, was substantially completed, and production of nickel was begun in 1943.[7] The plants are in Oriente Province, Cuba, and Wilmington, Del.

The operation involves open-pit mining of extensive deposits of silicate ore containing nickel, about 8 miles inland from the plant at Lengua de Pajaro, which is on deep water. After being crushed, dried, and ground to a very fine mesh, the dry dust is reduced in oil-fired furnaces, and the resulting reduced ore is leached in an ammonia solution from which the nickel is precipitated in the form of nickel carbonate. The nickel carbonate is in turn calcined to nickel oxide, which is shipped to the refinery at Wilmington, Del., where it is converted to nickel in electric furnaces.

Greece.—According to Berry:[8]

> The mining of nickel from the lentil-formed deposits in chalky stone near Larimna in Lokris, not far from Lake Kopais, has grown in importance. The raw ore goes mainly to Germany for processing. The ore is in widely scattered deposits of gabbro and peridotite stone, which have been partially serpentinized, and there are layers of nickel silicates with 4 to 8 percent nickel and 0.1 percent cobalt.

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[6] Falconbridge Nickel Mines, Ltd., 15th Annual Report: 1943, pp. 1–12.

[7] Freeport Sulphur Co., 31st Annual Report: 1943, p. 5.

[8] Berry, B. Y., American Consul General, Istanbul, Turkey, June 25, 1943.

COBALT

By H. W. Davis

SUMMARY OUTLINE

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SUMMARY

Although consumption of cobalt metal, oxide, salts, and driers was 32 percent greater in 1943 than in 1942, supplies were more than adequate to meet the controlled requirements. Consumption of cobalt in stellite and stellite-type alloys and in magnets and magnet steels increased markedly in 1943; these uses accounted for two-thirds of the total. The quantity used in high-speed steel declined substantially. Consumption of cobalt in alloy, ore, and speiss was 5 percent more than in 1942; and, as heretofore, most of it was supplied by imports (which established a new record), mainly alloy from Belgian Congo. Considerable cobalt ore was received from French Morocco in 1943, but none of it was processed. Domestic production is still comparatively small and was at about the same rate as in 1942. The new cobalt-nickel plant of the Ferro Enamel Supply Co., Cleveland, Ohio, began operating in September and made its initial production of cobalt oxide in November 1943; during 1943, 206,724 pounds of Burmese speiss, which contains about 7 percent cobalt, 30 percent nickel, 40 percent arsenic, and 10 percent copper, were charged into the system.

General Preference Order M–39, as amended by the War Production Board on March 9, 1943, placed cobalt under complete allocation. The supply position improved remarkably during the latter part of 1943, and as a consequence the allocation of cobalt was discontinued, effective December 30, 1943.

Domestic quotations for metal in 100-pound lots and for black oxide in 350-pound lots remained unchanged throughout 1943 at $1.50 and $1.84 a pound, respectively. These prices have been in effect since the latter part of October 1939. On November 2, 1943, the Office of Price Administration established maximum prices for cobalt metal, fines, powder, oxides, and other alloys and compounds of cobalt. The maximum price for metal containing a minimum of 97 percent cobalt was established at $1.50 to $1.57 a pound on contract and $1.60 to $1.67 on spot sales. The maximum prices for the other cobalt products were the highest charged by a seller on a delivery made during January, February, or March 1942. Cobalt ores, concentrates, and crudes were exempt from the provisions of the price regulation.

POST-WAR OUTLOOK

The post-war consumption pattern of cobalt in the United States will, with a few exceptions, probably not differ greatly from that of the pre-war, when the bulk of the cobalt was used for metallic purposes. However, as wartime restrictions were placed on many nonmetallic uses of cobalt, such, for instance, as ground-coat frit, a substantial increase in consumption for these purposes should result after the war. Because domestic production is relatively small and is not likely to increase greatly, the United States, as heretofore, will have to depend on foreign sources, probably Belgian Congo, for most of its requirements.

PRODUCTION AND DEVELOPMENT

The Bethlehem Steel Co., Bethlehem, Pa., was again the chief producer of cobalt ore in the United States. Production by this company was about the same in 1943 as in 1942, but shipments were 15 percent greater; the cobalt (averaging 1.34 percent in 1943) is contained in the sulfides that accompany the magnetite mined at Cornwall, Pa. The Eastern Magnesia Talc Co., Inc., Burlington, Vt., recovered 23 short tons of concentrates, containing 322 pounds of cobalt and 4,600 pounds of nickel, as a byproduct of the froth flotation of talc. The Sullivan Mining Co., Kellogg, Idaho, recovered 77 short tons of residues, containing 6,279 pounds of cobalt, at its electrolytic zinc plant. However, these two latter companies made no shipments in 1943.

The St. Louis Smelting & Refining Co. continued development and almost completed a mill at its properties near Fredericktown, Madison County, Mo., during 1943. The mill is expected to be in operation in early 1944.

According to Press Notice 29350, October 28, 1943, of the Bureau of Mines—

> Exploratory work by the Bureau of Mines has revealed more than 200,000 tons of copper-cobalt-gold ores in the Blackbird district of Lemhi County, Idaho, and a further search now under way may disclose the largest cobalt-ore reserves in the United States, as well as substantial tonnages of copper.

CONSUMPTION

Consumption of cobalt contained in alloy, ore, and speiss was 5,394,000 pounds in 1943 compared with 5,161,000 pounds in 1942. Of the consumption in 1943, about 88 percent was processed to metal, oxide, and hydrate and 10 percent to driers and salts; 2 percent was used in magnets and magnet steels.

FOREIGN TRADE[1]

Imports.—Imports of cobalt into the United States established a new record in 1943; they were 36 percent greater than in 1942 and 15 percent more than in 1941, the previous record year. The chief source of imports in 1943 was Belgian Congo, which supplied 10,110,879 pounds in the form of an alloy containing 4,357,335 pounds of cobalt.

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[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

French Morocco supplied 8,873,156 pounds of ore containing 1,098,228 pounds of cobalt. The ore from French Morocco contains also 5 to 30 grams of gold per ton, but none of it was processed in 1943 because of certain metallurgical problems involved in recovering both the cobalt and the gold and also because the supply situation was not serious enough to necessitate the solution to these problems. The imports of ore credited to Algeria and India by the United States Department of Commerce have been included in the total shown for French Morocco, inasmuch as the ore was mined in that country; moreover, the imports credited to India, recorded as 200,000 pounds containing 76,480 pounds of cobalt, have been corrected by the author to 184,000 pounds containing 22,100 pounds of cobalt. Canada supplied 256,670 pounds of metal, 58,928 pounds of oxide, and 1,693,525 pounds of ore containing 268,256 pounds of cobalt.

Cobalt imported for consumption in the United States, 1939–43, by classes[1]

Year	Alloy			Ore			Metal	
	Pounds		Value	Pounds		Value	Pounds	Value
	Gross weight	Cobalt content		Gross weight	Cobalt content			
1939				611,083	(²)	$54,446	2,130,296	$2,711,677
1940	7,843,828	(²)	$3,364,294	2,653,891	(²)	296,575	130,321	207,345
1941[1]	9,970,589	4,064,276	4,330,085	2,443,725	262,653	257,702	554,030	842,288
1942	[3] 10,313,867	[3] 4,188,687	[3] 3,971,056	834,797	91,597	99,898	148,304	228,452
1943	[4] 10,110,879	[4] 4,357,335	(²)	10,566,681	1,366,484	1,723,565	256,670	358,948

Year	Oxide		Sulfate		Other salts and compounds	
	Pounds	Value	Pounds	Value	Pounds	Value
1939	680,644	$944,836	75,290	$34,343	1,374	$3,405
1940	756,759	1,124,554	11,468	7,818		
1941	38,002	55,120	4,480	3,779	500	885
1942					200	448
1943	58,928	95,463			56	164

[1] In addition to classes shown, 4,796,000 pounds of Burmese speiss, containing 335,721 pounds of cobalt, were reported by the processor to the Bureau of Mines as imported in 1941; value not available.

[2] Data not available.

[3] Includes 2,384,915 pounds of alloy, containing 980,000 pounds of cobalt and valued at $867,799, received in December 1942 but recorded as January 1943 by the United States Department of Commerce.

[4] Reported by importer to Bureau of Mines

Exports.—Exports of cobalt are relatively small, as is evident from the following table:

Cobalt exported from the United States, 1942–43, by classes

Class	1942		1943	
	Pounds	Value	Pounds	Value
Ore and concentrates	1,052	$1,015	38,755	$58,182
Metal and alloys	90,679	135,229	368,989	537,664
Oxide	12,079	18,540	14,699	29,105
Salts and compounds	15,056	7,255	20,836	17,955

USES

The largest single use of cobalt is in stellite or stellite-type alloys, which contain 45 to 55 percent cobalt, 30 to 35 percent chromium, and 12 to 17 percent tungsten; there are various modifications of this composition, but all contain high percentages of cobalt. These alloys absorbed about 43 percent of the total cobalt consumed in 1943. The second-largest use is in magnets and magnet steels, which utilized 23 percent of the total cobalt consumed. Other important applications are in high-speed steels and other cutting-tool materials, valve steel, welding rod, and carbide-type alloys; these outlets comprised about 14 percent of the cobalt consumed. Smaller quantities are employed in the ceramic industry, in the preparation of driers, in electroplating, as a catalyst, and for a variety of other uses; of the total cobalt consumed, 13 percent was used in driers, 3 percent in ceramics, and 4 percent for electroplating, catalyst, and other applications.

WORLD PRODUCTION

As cobalt productioon data for many countries are lacking, it is impossible to prepare an accurate statement of world output. The following table shows world production by countries, 1938–43, insofar as statistics are available.

World production (partly estimated) of cobalt, 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	Cobalt-bearing material	Cobalt content					
		1938	1939	1940	1941	1942	1943
Australia	Cobalt ore	(3)	(2)	(3)	(3)	5	(3)
Belgian Congo	Cobalt alloy	1,532	(2)	[4] 1,423	[4] 1,844	[4] 1,900	[4] 1,976
Bolivia (exports)	Cobalt ore			2	2	28	189
Burma	Cobaltiferous nickel speiss	[5] 238	[5] 229	2 8	73	(2)	(3)
Canada	Cobalt ores, oxide, and metal	208	332	360	119	38	77
Morocco, French	Cobalt ore	720	719	700	700	400	(2)
Northern Rhodesia	Cobalt alloy	[5] 1,073	[5] 1,598	(2)	(2)	(2)	(2)
United States	Cobalt ore			(6)	(6)	(6)	(6)

[1] In addition to countries listed Brazil, Chile, China, Finland, Germany, Italy, Japan, and Mexico produce cobalt, but production data are not available.
[2] Data not available.
[3] Less than 1 ton.
[4] Imports into United States.
[5] Year ended June 30 of year stated.
[6] Bureau of Mines not at liberty to publish figures.

Belgian Congo.—Belgian Congo continues to be the world's chief source of cobalt. Cobalt is mined as such and as a high-grade copper-cobalt ore. It also occurs with sulfide and carbonate copper ores, from both of which partial recovery is made by concentration. To keep its installations up to date and to increase production, the Union Minière du Haut Katanga resumed operations at the mine and cobalt-concentrating plant of Kabolela and installed two new electric furnaces and a cobalt-recovery plant at Jadotville. It was opening and equipping a new cobalt mine and ore-treatment plant at Kamoto and erecting a plant at Jadotville for the production of electrolytic cobalt. Production data for Belgian Congo have not been published since 1938. when

1,532 metric tons were produced. However, since the invasion of Belgium, where Belgian Congo alloy formerly was processed, the entire output has been shipped to the United States, and during the 4 years 1940–43 imports have averaged 1,786 metric tons, indicating that production has increased since 1938.

French Morocco.—French Morocco is an important producer of cobalt, and during the time it was occupied by Germany probably the bulk of Germany's supply was obtained from that source. The cobalt production of French Morocco has been allocated to the United States by the Combined Raw Materials Board, and in 1943 imports from that country amounted to 4,437 short tons of ore containing 1,098,228 pounds of cobalt.

According to Brooks:[2]

> Cobalt deposits of the Protectorate are exploited by the most modern mining methods. They are found in pre-Cambrian strata which form the substructure of the Anti-Atlas Mountains. The pre-Cambrian crops out in a certain number of eruptions, of which the best known is that of Bou-Azzer, East of Tazanakht. It is a linear discontinuous cropping out running towards the South-East with a maximum of 60 kilometers in length and of 8 kilometers in width. The component rocks are sedimentary or eruptive and the ore resembles smaltine (gray cobalt), skutterudite or safflorite, which make up the crystalline aggregates at Bou-Azzer. But these aggregates consist of rather complex disparate elements. Waters flowing along the veins are light solutions of cobalt and nickel and contain arsenate of iron. Virgin gold is also found in the veins attached to the cobalt ore or, at times, concentrated in very fine clay. The gold content varies from 5 to 30 grams per ton. Average cobalt content of commercial ore is 11 to 12 percent, although there are other commercial-grade ores with a cobalt content as low as 0.75 to 1.25 percent. The mines of Bou-Azzer and of Graara are very well equipped, are in full operation, and contribute to the supplying of industrial requirements of Allied countries.

Northern Rhodesia.—Northern Rhodesia is second to Belgian Congo as a producer of cobalt. The production of cobalt in Northern Rhodesia has been described by the South African Mining and Engineering Journal,[3] from which the following is quoted:

> Cobalt occurs associated with copper in certain of the ore found in the copper mines of Northern Rhodesia. At the Nkana mine of the Rhokana Corporation, the copper-bearing minerals in the ore are mainly bornite, chalcopyrite, chalcocite, and carrollite. Copper occurs almost entirely as sulfides, less than 1 percent of the total copper appearing as oxidised forms, mainly malachite and cuprite, with a little native copper. The principal cobalt mineral is carrollite, but about 5 percent of the total cobalt in the ore occurs in the oxidised form asbolite. The percentage of cobalt in the ore varies considerably from nil to as high as 0.6 to 0.9, but the average percentage of cobalt in the ore treated in the Nkana plant is in the region of 0.15. Since the copper minerals at the Nkana mine are almost entirely sulfides, concentration by flotation would be quite simple were it not for the presence of cobalt. The recovery of cobalt necessitates making two concentrates—one high in copper and low in cobalt, and one low in copper and high in cobalt. * * * The two concentrates are treated separately in the reverberatory furnaces. * * * In the reverberatory furnaces a sulfide matte containing principally copper, iron, cobalt, and sulfur is formed in the bottom of the furnace, while a slag layer, consisting mainly of silicates, is formed on the top of the matte. The two products can thus be tapped off separately, the slag going to waste and the matte to the converters. * * * The presence of cobalt introduces a complication in the converter practice. Cobalt oxidises before copper, so that an impure cobalt oxide can be removed as a silicate in the slag. This slag, in practice, is a mixture of cobalt, iron, and copper, present as oxides, sulfides, and silicates, together with silicates of aluminum, calcium, and magnesium.

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[2] Brooks, R. M., American Consul, Casablanca, Morocco, May 12, 1943.

[3] South African Mining and Engineering Journal, Production of Cobalt—Process Adopted at Nkana Mine: Vol. 54, part I, No. 2635, July 31, 1943, pp. 465, 467.

Silica is added to the converter to form a fluid slag. The slag formed from the cobalt-rich concentrate is granulated and sent to the electromelt furnace. Coke is added to the slag containing cobalt, iron, and copper. An alloy containing copper, iron, and cobalt is then formed, and an electric furnace slag is also produced. The alloy is then granulated and is ready for shipment to the refinery for the recovery of cobalt. The slag is disposed of as waste. From an alloy of the above type, it is possible to produce ferrocobalt and pure cobalt by electrolytic deposition. * * * The production of pure cobalt from alloy is more difficult than the production of ferrocobalt, because of difficulties encountered in the iron purification step. * * * The above process can be used for the production of pure cobalt metal, ferrocobalt, cobalt oxide, and cobalt sulfate.

U. S. S. R.—According to Dudavsky:[4]

Before the war, the output of this metal (cobalt), so vital to the war industry, was inconsiderable, and supplies were almost entirely controlled by our Allies. In the U. S. S. R., too, extraction was not large. A small quantity was obtained by hydrometallurgical methods from cobalt ores and byproducts of copper smelting. A few years before the war, however, considerable quantities were found in the nickel ores of the Kazakhstan and Murmansk regions. Deposits were discovered of cobalt, manganese-cobalt, and arseno-cobalt ores. Among the Urals' resources were deposits of copper-pyrites, copper-nickel, and silicate-nickel ores, which contained cobalt. Though their existence and their location had been known for over a century, their exploitation was never attempted. Their complex character, the low percentage of cobalt they contained, demanded too elaborate a process of extraction: very costly appliances were required, and this made the whole process unprofitable from an economic standpoint. But the problem of obtaining cobalt acquired increasing importance for the Soviet war industry. * * * But if cobalt was to be obtained on a large industrial scale from the Urals' ores, it was necessary to work out a new and efficient technology for the dressing and separation of complex ores. Experiments were carried out on a big scale at one of the dressing plants in the Urals. These were preceded by numerous laboratory experiments. Soviet scientists solved the problem of dressing and separating cobalt ores into their compound minerals. The opening of the cobalt mines in the Urals was speeded up. Now they are fulfilling their production program. The dressing plants keep pace with output.

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[4] Dudavsky, V., Cobalt from the Urals: Embassy of the Union of Soviet Socialist Republics, Inf. Bull., vol. 4, No. 6, Washington, D. C., January 15, 1944, p. 7.

MOLYBDENUM

By C. E. Nighman and Alice P. van Siclen

SUMMARY OUTLINE

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SUMMARY

"Moly" stood in an eminently satisfactory statistical position at the end of 1943, as a result of producers' exertions, wartime controls, and versatility of molybdenum among the important alloying elements. The war-stimulated demand for molybdenum (augmented by its substitution in part for tungsten), which boosted consumption of concentrates to over 28,000 short tons of contained molybdenum in 1942, continued during the first 5 months of 1943. Despite the all-out efforts of domestic producers to pace requirements, inventories of concentrates dwindled at an alarming rate. The turning point came in the late spring of 1943, when consumption dropped sharply and stocks began to rise. The tight situation was eased largely through reduction in the armament program, with attendant reduction in output of alloy steels, conservation of molybdenum through increased use of the NE steels containing 0.25 percent or less Mo, and greater employment of scrap.

A new high in mine production was established, both for a year and for a single month. The 8-percent increase over the 1942 total was accompanied by a million-pounds (Mo content), or 138-percent, rise in imports, largely for Government stock-piling, as Western Hemisphere countries responded to the needs of the United Nations. On the other hand, internal consumption dropped 11 percent, and exports—virtually all Lend-Lease—receded 9 percent compared with those of the preceding year. The net effect was to increase total domestic stocks roughly 50 percent to the equivalent of 6 months' requirements at the average use rate of the last quarter of 1943. Details for the period July 1941 to December 1943 are given in a subsequent table.

Salient statistics of the molybdenum industry in the United States, 1939–43, in thousands of pounds of molybdenum contained in concentrates

	1939	1940	1941	1942	1943
Production	30,324	34,313	40,162	[1] 56,918	61,406
Imports for consumption [2]	26		4	756	1,789
Shipments (including exports)	32,415	25,329	38,200	66,437	53,706
Consumption	(3)	(3)	[4] 16,891	56,388	49,891
Stocks (industry) December 31	(3)	(3)	21,200	12,491	[5] 17,750

[1] Revised.

[2] Molydenum content of molydenum products (1939) and of ores and concentrates (1941–43).

[3] Data not available.

[4] 6 months, July to December.

[5] Government stocks at the end of 1943 contained 2,167,273 pounds of molybdenum.

POST-WAR OUTLOOK

Since the United States has exported more molybdenum than it has consumed, except in the war years, the future trend in use will be determined by foreign purchasing power. The potential demand, principally for structural and engineering steel for reconstruction and rehabilitation, will be very great, but much of the material needed may be derived from battlefield scrap and surplus war matériel, both at home and abroad. An orderly and relatively long-term disposal of such material probably would not bring about a serious market contraction. A counterbalancing factor will be further industrialization in the U. S. S. R., heretofore a substantial consumer. Japan was also a large molybdenum buyer, but its smaller future requirements will be at least partly offset by China's needs. In this country, steel output probably will be higher than the pre-war average, with a tendency for alloy steels to be an increasingly larger component. Although there is a strong likelihood that some of the war-created low-alloy steels will find continuing application, the use of molybdenum will not be greatly affected, as it is a constituent of virtually all that are expected to persist. In general, the consumption of new supplies of molybdenum may be expected to rise in the post-war period but at a rate considerably below that in evidence in the 1930's.

WAR REGULATIONS

In April 1943 amended General Preference Order M-21-h, requiring that 75 percent of all high-speed steel orders accepted in any one quarter be of the molybdenum type and not more than 25 percent of the tungsten type, was modified to permit a leeway of 5 percent by weight, or within 500 pounds, in meeting the required ratio. Receipts of 100 pounds or less of high-speed steel are exempt from provisions of the order. Further amendment on May 12 raised the permitted ratio of tungsten-type high-speed steels to 35 percent, thereby decreasing the molybdenum requirement. Supplementary Order M-110-a, as amended (October 2), authorized the acquisition of 500 pounds or less of molybdenum by foundries to fill certain high-preference orders without going through allocation proceedings. Molybdenum was removed completely from allocation on December 30 by the issuance of General Preference Order M-110-a. However, vendors of more than 2,000 pounds of molybdenum in any 1 month were required to report all sales to the War Production Board. Molybdenum ingot, wire, and sheets continued on allocation (General Preference Order M-369, December 31).

Price-control regulations are given in the section on Prices.

PRICES

The First World War period, 1914-18, marked the beginning of consistent molybdenum-ore domestic production. The United States quickly became the world's premier supplier in response to strong foreign demand. The highest prices known were those of 1917, when the average sales price was about $4.50 per pound molybdenum contained in ferromolybdenum (60 to 70 percent Mo), and MoS_2 averaged $2.10 a pound in 90-percent MoS_2 concentrate. The rapid development of the tremendous Climax deposit from 1918 on and the relatively slow acceptance of the metal for alloying purposes precipitated a downward movement in ferro price that continued uninterruptedly through 1931. In February 1932 a final drop of 5 cents brought the price to 95 cents a pound; it remained at this level until frozen and subsequently became a specific ceiling under the provisions of M. P. R. 489, effective November 8, 1943. Price-control history and general provisions of M. P. R. 489, given in the chapter on Vanadium, apply also to molybdenum. The specific maximum prices for the principal products, per pound contained Mo, follow:

Ferromolybdenum	$0.95
Molybdic oxide, technical (powder or briquets)	.80
Calcium molybdate	.80

The maximum prices for other molybdenum products (molybdenum metal powder, molybdenum carbide powder, molybdic acid, molybdenum trioxide, molybdenum silicide, sodium molybdate, ammonium molybdate, other molybdenum alloys, and compounds consumed principally by the metallurgical industry) were to be the highest prices charged or quoted for such products by a seller on a delivery made during January, February, or March 1942 to a purchaser of the same class.

No ceiling price was fixed for ores and concentrates. The nominal price, however, of 45 cents a pound MoS_2 in the standard 90 percent MoS_2 concentrate that has prevailed since 1938, continues to be quoted.

UNITED STATES

PRODUCTION

Despite a labor shortage at Climax and curtailed operation at the end of the year, 1942 domestic output was topped by 8 percent to reach a new peak of 61,406,000 pounds of molybdenum in concentrates. Since 1918 the Climax Molybdenum Co. has maintained its leadership in domestic production. Its share, however, has declined somewhat since byproduct recovery from copper mines began in 1936. In 1943 Climax also set an all-time production record of over 46 million pounds contained molybdenum in concentrates and supplied 75 percent of the United States production. Of the remainder, 22 percent was furnished by copper mines and 3 percent by others.

Domestic shipments from 1914 to 1943, inclusive, are shown in the accompanying table. The pattern of the 19-percent decline in 1943 shipments is traced by months in the summary table in the section on Consumption and Uses.

Molybdenum in ore and concentrates shipped from mines in the United States, 1914–43 [1]

Year	Pounds	Value [2]	Year	Pounds	Value [2]
1914–18	1,601,643	$2,070,213	1939	32,415,000	$22,157,000
1919–23 [3]	355,493	370,371	1940	25,329,000	17,189,000
1924–28	8,498,343	6,160,304	1941	38,200,000	25,883,000
1929–33	18,954,917	11,406,000	1942	66,437,000	[4] 47,275,000
1934–38	94,077,000	64,244,000	1943	53,706,000	38,346,000

[1] For shipments by years, 1914–38, see chapter of this series for 1941.
[2] Largely estimated by Bureau of Mines.
[3] No shipments in 1920 and 1921.
[4] Revised figure.

To stimulate domestic production and provide a ready market for molybdenite concentrates, the War Production Board recommended that the Metals Reserve Co. institute a small-lot purchasing program. On July 8, 1943, a buying schedule was announced. Since it was desired to develop new operations, it was provided that no concentrates were acceptable from a producer whose monthly output during the first 6 months of 1943 averaged more than 24,000 pounds of contained molybdenite, except by special arrangement. This automatically eliminated the seven regular producers of molybdenum ores and concentrates. Metals Reserve Co. offered 37 cents per pound of contained MoS_2 in concentrates (delivered at its purchasing depots) that would meet the following specifications: MoS_2—minimum 80 percent; copper—maximum 0.5 percent; lead—maximum 0.3 percent; phosphorus—maximum 0.1 percent. The maximum copper content acceptable was 1.0 percent, but penalties of 1 cent per pound of contained MoS_2 were to be imposed if the copper content was above 0.5 percent up to and including 0.8 percent; and 2 cents per pound if above 0.8 percent up to and including 1.0 percent. No purchases were made during the year.

REVIEW BY STATES

Arizona.—Two producers of molybdenum concentrates were active in 1943. Miami Copper Co. continued the recovery of molybdenite from copper operations at Miami and produced and shipped molybdenum oxide. The molybdenum recovered by Mammoth-St. Anthony, Ltd., from complex ore at Tiger, Ariz., was marketed as calcium molybdate.

Bagdad Copper Corporation installed an experimental unit for the recovery of molybdenite from copper ore mined near Hillside, Yavapai County. Production was expected to begin early in 1944.

Colorado.—Despite labor shortages and curtailment of operations at the end of the year, molybdenum production by Climax Molybdenum Co. in 1943 rose to 45,489 short tons of concentrates, containing 46,133,715 pounds of molybdenum, exceeding the record of the previous year by 10 percent and bringing the total output from 1918–43 to over 268,000,000 pounds of contained molybdenum. In September 1942 this company was awarded an Army-Navy E pennant for excellence in production. A renewal of the award was made in April 1943. The importance placed on maintenance of production from the world-famous Climax deposit was indicated in the spring of 1943, when the Climax Co. was listed first in the War Manpower Commission list of labor priorities for nonferrous metal mines.

The construction of an additional mill unit was completed and put into operation in 1942. The capacity of the drying and regrind plants was increased, and a 125-foot thickener was installed. This new construction raised the daily milling and treating capacity of the plant to 18,000 to 20,000 tons of ore. The plant operated throughout 1943 at the average daily rate of 17,600 tons.

At Langeloth, Pa., Climax Molybdenum Co. converts a large part of its production of concentrates to molybdenum oxide, molybdic oxide briquets, ferromolybdenum, calcium molybdate, and other industrial products.

The Molybdenum Corporation of America reacquired the Urad mine about 10 miles west of Empire in Clear Creek County [1] from the

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[1] Minerals Yearbook, 1942, p. 661.

Metals Reserve Co. An 1,150-foot raise, 8 by 19 feet in cross section, was completed in the very short time of 8 months. It starts about half a mile from the portal of an old adit, which is at an elevation of 10,500 feet above sea level, and connects with old workings that were several hundred feet deep. Because of labor shortage, only development is now under way. A mill with a crushing section for 1,000 tons per day and a 200-ton flotation unit was erected. In the spring of 1944 about 90 tons of ore from development were being milled daily. The company also purchased 400 acres of adjacent mineral land. It was reported that developments were proving satisfactory.

Nevada.—It has been reported that molybdenite has been found over a wide area in drilling below shallow workings of the old Fifty-Six mine near Imlay, Pershing County.

New Mexico.—Production of molybdenite concentrates at the Questa mine of the Molybdenum Corporation of America continued at an increased rate. A brief description of the property and historical record of production from 1919 to 1942, inclusive, appeared in the Molybdenum chapter of Minerals Yearbook, 1942 (pp. 659-660). Byproduct recovery of molybdenum at the Chino property of Kennecott Copper Corporation, which began in 1937, was also continued throughout 1943.

Utah.—Second only to Climax Molybdenum Co. is the molybdenum operation of Utah Copper Co. Molybdenum concentrates have been recovered since 1936 as a byproduct of copper operations, and in 1943 production reached the highest level so far recorded.

Washington.—Several hundred tons of low-grade ore were mined from the property of Consolidated Mines & Smelting Co., Ltd., in Ferry County near Keller, but none was treated or shipped.

EXPLORATION AND DEVELOPMENT

The Bureau of Mines and Geological Survey continued their investigational and exploratory programs individually and cooperatively during 1943.

In Alaska the Bureau announced plans for developing molybdenum properties in the Virginia Lake district and on the Ohog River, 30 miles from Aniak. The Geological Survey examined a molybdenite deposit on the east coast of Baker Island, one of the large islands off the west coast of Prince of Wales Island, and prepared a preliminary map of the deposit. The Shakan deposit, Kosciusko Island, southeastern Alaska, was also examined and mapped. Findings were summarized as follows: [2]

> The molybdenite deposits near Shakan, Kosciusko Island, southeastern Alaska, are in a narrow-low-dipping fault zone in hornblende diorite. * * * Surface and underground workings expose one ore shoot which probably contains between 10,000 and 20,000 tons of measured and indicated ore containing about 1.5 percent MoS_2. A few tens of thousands of tons of additional ore may be inferred in extensions of the known ore shoot and in shoots not now exposed.

In Arizona the two agencies examined and sampled the Amargosa molybdenum-copper mine, Pima County, and the Copper Hill and Loma Prieta properties in the Copper Basin mining district of Yavapai County. Assays and concentration tests were made by the Bureau of Mines on samples from the Amargosa mine and from the

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[2] Robinson, G. D., The Shakan Molybdenite Deposit, Kosciusko Island, Southeastern Alaska: Geol. Survey mimeo. report, undated, 9 pp., 5 figs.

Leviathan property in Mohave County, which was reported to have been a notable producer during the First World War. Examinations were made by both agencies on molybdenum deposits in Custer County, Idaho, near Neihart, Cascade County, Mont., in the Tonopah (Nev.) district, and in Okanogan County, Wash. The Bureau also examined the Kromona mine, 25 miles northeast of Sultan, Snohomish County, Wash., and conducted exploratory work at the old Liberty mine, a former silver-lead producer, north of Tonopah, Nev. As the work performed failed to disclose ore of sufficiently high grade, the project was discontinued on November 15. In addition to many brief examinations of reported molybdenum occurrences the Geological Survey made investigations in the vicinity of Pine Creek, Inyo County, Calif., and of molybdenite prospects about 5 miles east of Hollister, N. C. Preliminary geologic maps of the North Carolina properties were released.

CONSUMPTION AND USES

Used only experimentally in the production of war matériel—principally armor plate—in this country near the end of the first world conflict, molybdenum is now considered one of the most important alloy metals. Among its properties, molybdenum imparts high creep resistance and depth hardness to steels. It makes possible high working temperatures, to acquire toughness without sacrifice of hardness and without development of brittleness on cooling. It thus finds a wide range of usefulness, from the so-called straight molybdenum type to the multiple low-alloy National Emergency series steels. In cast irons it increases tensile strength, wear, and impact resistance, with little or no effect on machinability. Another important characteristic is its substitutability to a considerable extent for other alloying elements especially tungsten. More than 95 percent of consumption is in steels, mostly in the form of molybdenum oxide, ferromolybdenum, and calcium molybdate; about 3 percent is in cast iron; and limited employment is found in the chemical and ceramic industries. The pure metal is used in negligible quantity but is of highly strategic importance in radio and radar equipment.

Owing to its great utility, molybdenum had been classified as a strategic mineral before the present war broke out; however, even after the United States became a participant, domestic productive capacity appeared ample to meet our needs for war and essential civilian requirements. By midsummer 1942 alloy-steel output had increased greatly (about 35 percent over the January production), as had the Allied demand. Molybdenum was then classified by the War Production Board as insufficient for war needs alone, and a few weeks later—in the latter part of August—was placed in the most critical group of that class. Further growth in alloy-steel output, enhanced by the tungsten shortage, brought about a sharp decline in industry stocks, so that 1943 opened with about half the supply of concentrates available at the beginning of 1942. Notwithstanding the stringent allocation controls, the high rate of consumption that first exceeded 5 million pounds monthly in June 1942 continued through May 1943. At the end of that month, industry stocks reached the lowest point recorded since the Bureau of Mines undertook monthly industry surveys in July 1941. At this dangerously low level, total industry stocks barely exceeded 8 million pounds, with those of producers under 3,500,000 pounds, or roughly only 3 weeks' supply at the then current rate of use. Subsequent shifts and cut-backs in military requirements rapidly reduced the consumption rate to little more than 2 million pounds in December, a figure below the average for the latter half of 1941 and less than 39 percent of the peak recorded in January 1943.

The combination of the severely reduced demand and large mine output speedily improved the supply position so that in October 1943 molybdenum was reclassified as again available for all essential needs.

The situation with respect to molybdenum products was relatively static from July 1941 through March 1943, with industry stocks held close to the 9 million pounds (molybdenum content) considered the minimum safe working level. Henceforward slight accretions were permitted as the raw-material position was bettered, and the year ended with 12 million pounds in consumers' and producers' hands, or essentially the excess of production over consumption in the 2 years 1942–43. The industry advisory committee to the War Production Board recommended a minimum stock pile of 24,000,000 pounds Mo in usable form in October 1943. This objective had been reached about the end of August. At the year end industry stocks of concentrates and molybdenum products were nearly 30,000,000 pounds (Mo content). In addition, Government holdings exceeded 2 million pounds. With an expected continuation of exports at the low rate prevailing in the last quarter of 1943, the War Production Board estimated the 1944 requirements, including Lend-Lease, to be slightly over 11 million pounds (Mo content in usable form) each quarter or 44,561,000 pounds for the year. Total available supply at the beginning of 1944 was therefore equivalent to about 8 months' over-all needs.

The status of domestic molybdenum concentrate production, consumption, and stocks and the consumption of molybdenum products since July 1, 1941, are shown in the accompanying tables.

United States production, shipments, consumption, and stocks of molybdenum concentrates,[1] July 1941 to December 1943, inclusive, in thousands of pounds of contained metal

Period	Production	Shipments—		Consumption	Stocks at end of period	
		To domestic consumers	For export		Producers'	Consumers'
1941: July-December	22,477	17,720	5,838	16,891	17,348	3,852
1942: January-December	[2] 56,918	58,001	8.436	56,388	7,808	4,683
1943:						
January	5,194	5,268	321	5,695	7,425	4,244
February	4,579	4,844	748	5,084	6,412	4,038
March	5,446	5,559	870	5,215	5,428	4,669
April	4,753	4,995	1,267	5,224	3,919	4,438
May	5,279	5,458	267	5,181	3,484	4,577
June	5,258	3,109	306	3,837	5,326	3,934
July	5,683	3,735	739	3,662	6,535	3,969
August	5,401	3,901	878	3,694	7,156	4,005
September	5,819	4,164	612	3,502	8,199	4,725
October	5,792	2,415	777	3,427	10,799	4,017
November	4,786	2,525	242	3,195	12,818	3,333
December	3,417	726		2,175	15,508	2,242
Total	61,406	46,689	7,017	49,891	15,508	2,242

[1] Includes smelter salts from complex ores.

[2] Revised figure.

Consumption of molybdenum products in the United States, July 1941–December 1943, in thousands of pounds of contained molybdenum

Period	Ferromolybdenum	Calcium molybdate	Molybdenum oxide[1]	Other[2]	Purchased scrap	Total
1944: July-December	3,899	2,724	6,546	372	510	14,051
1942: January-December	10,673	5,501	27,824	414	1,252	45,664
1943:						
January	864	552	2,992	45	132	4,585
February	676	546	2,692	42	225	4,181
March	713	560	2,935	39	250	4,497
April	662	537	2,499	47	274	4,019
May	573	479	2,432	53	298	3,834
June	538	437	2,105	50	281	3,411
July	490	403	1,964	49	308	3,214
August	491	371	2,045	53	265	3,225
September	452	370	1,809	52	268	2,951
October	429	321	1,889	57	244	2,940
November	402	287	1,610	56	202	2,557
December	373	237	1,411	37	193	2,251
Total	6,663	5,099	26,383	580	2,940	41,665

[1] 1942–44, includes molybdenum trioxide and molybdic acid.

[2] Ammonium molybdate, sodium molybdate, molybdenum silicide, molybdenum metal, and alloys (molybdenum trioxide and molybdic acid in 1941).

FOREIGN TRADE [3]

Ordinarily imports of molybdenum ores and concentrates are insignificant. The sharp rise in 1943 to 1,788,652 pounds (contained molybdenum) was due largely to the marked increase in receipts from Chile. Imports of Canadian concentrates, which began in the fourth quarter of 1943, were for treatment and return to the Dominion.

Export statistics have been available only since 1939. During the war period about 20 percent of domestic shipments has been exported; in previous years the percentage was estimated at 50 to 75. Imports and exports of molybdenum in recent years appear in the accompanying tables.

Molybdenum ore and concentrates imported for consumption in the United States, 1942–43, by countries

Country	1942			1943		
	Pounds		Value	Pounds		Value
	Gross weight	Molybdenum content		Gross weight	Molybdenum content	
Cameroon				1,135	284	$150
Canada	54,100	1,082	$725	[1] 443,176	[1] 216,398	205,716
Chile	1,277,427	664,479	495,208	2,592,636	1,405,228	922,483
Cuba	175,287	90,389	58,299			
Mexico				21,429	11,000	6,172
Peru				270,296	155,742	103,665
	1,506,814	755,950	554,232	3,328,672	1,788,652	1,238,186

[1] Imported for conversion and reexport.

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[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Molybdenum ore and concentrates exported from the United States, 1942–43, by countries

Country	1942			1943		
	Pounds		Value	Pounds		Value
	Gross weight	Molybdenum content		Gross weight	Molybdenum content	
Australia	----------	----------	----------	206,416	103,208	$85,120
Canada	1,957,453	1,006,495	$816,280	1,642,469	843,500	654,850
India and Dependencies	----------	----------	----------	34,000	20,900	19,683
Southern Rhodesia	----------	----------	----------	502	300	477
U. S. S. R	10,339,064	6,107,213	3,960,079	8,086,076	4,110,399	2,996,541
United Kingdom	9,182,495	4,482,932	3,182,303	9,738,190	4,992,850	3,470,543
	21,479,012	11,596,640	7,958,662	19,707,653	10,071,157	7,227,214

WORLD PRODUCTION AND DEVELOPMENTS

Examinations of molybdenum deposits in Latin American countries were made by geologists of the Federal Geological Survey in Colombia and El Salvador, under the auspices of the Foreign Economic Administration, and in Lower California and Sonora, Mexico, under the auspices of the United States Department of State.

Canada.[4]—The feverish search for molybdenum deposits in Canada in 1942 apparently subsided. In 1943, although a certain amount of exploration and development continued, output came principally from three producers in Quebec—Indian Molybdenite property in Preissac Township, the La Corne Molybdenum project[5] (sponsored by Wartime Metals Corporation under the management of Siscoe Gold Mines), and the Quyon Molybdenite Co. at Quyon. Milling operations at the Indian Molybdenite property began late in September, and by the end of the year ore was being treated at the rate of 350 tons per day; production during the year was 22,739 tons of ore. A 50-ton mill was erected on the property of Vic-Ore Molybdenite Mines, Ltd., 38 miles north of Ottawa, and the first shipment of concentrates was made in November 1943.

Canadian self-sufficiency in molybdenite was claimed in 1943, and during the last 3 months of the year substantial shipments were made to the United States for treatment and return to the Dominion. However, production is expected to cease early in 1944, as the Canadian Government canceled its contract with Indian Molybdenum, Ltd., as of April 30, 1944.

Chile.—Molybdenum concentrate output obtained as a byproduct from copper operations by the Braden Copper Co. was contracted for by Metals Reserve Co.

Macedonia.—According to the Bulgarische Wochenschau,[6] one-tenth of the population (14,000 people) is employed in mining chromite, lead, zinc, and molybdenum. About 9,000 persons are said to be working in molybdenum mines, and output is claimed to be the highest in Europe and the fourth highest in the world.

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[4] Occurrences and milling of Canadian molybdenite are described by: Claudet, H. H., Molybdenite in Canada: Canadian Inst. Min. and Met. Bull. 383, March 1944, pp. 87–98.

[5] Norman, G. W. H., Molybdenite Deposits and Pegmatites in the Preissac-La Corne Area, Abitibi County, Quebec (abst): Econ. Geol., vol. 39, No. 1, February 1944, p. 100.

[6] Iron and Coal Trades Review, No. 3956, December 24, 1943, p. 1000.

Manchuria.—Further indication of molybdenum production in Manchuria (see Minerals Yearbook, 1942, p. 664) is contained in the announcement by the president of the Manchurian Industrial Development Corporation[7] that production of molybdenum in the second quarter of 1943 was 100.5 percent of that in the corresponding period of 1942; steel was 151.5, pig iron 111, coal 107, lead 134.6, and zinc 258.9; 1942 was the first full year of the 4-year plan now in effect.

Mexico.—Import duties on molybdenum entering the United States from Mexico were reduced 50 percent under terms of a trade agreement between the two countries signed December 23, 1942, and effective January 30, 1943. The agreement is for 3 years, with automatic extension to 6 months after expiration unless either party notifies the other of intention to terminate. All receipts are for the account of Metals Reserve Co.

Norway.—The Knaben mines in Norway are the largest source of molybdenum in Europe, and for many years Norway was the second-largest producing country. Being one of the few sources of molybdenum available to the Axis, production has undoubtedly been pushed to the limit during World War II. In 1943, however, these efforts were thwarted by bombing of the Knaben mines by the R. A. F. in March, when three-fourths of the German supply is believed to have been knocked out, and again in November, when a further attack by British-based American heavy bombers severely reduced Norway's ferro-alloy output as well as that of light metals.

World production of molybdenum in ores and concentrates, 1938–43, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Australia[1]	32	39	20	10	8	(2)
Canada[1]	3	(3)	5	46	54	198
Chile	....	30	267	229	580	680
Mexico	483	523	310	522	855	1,138
Morocco, French (exports)	94	(2)	(2)	(2)	(2)	(2)
Norway	462	433	288	233	363	(2)
Peru	85	167	190	148	[4] 194	[4] 99
Turkey	41	(2)	(2)	(2)	(2)	(2)
United States	15,103	13,755	15,564	18,217	25,818	27,854
Other countries[5]	(5)	(5)	(5)	(5)	(5)	(5)
	[6] 16,310	[6] 15,100	[6] 16,800	[6] 19,500	[6] 28,000	[6] 30,000

[1] Gross weight of ore and concentrates reported; molybdenum content estimated by authors.
[2] Estimate included in total.
[3] Less than 1 ton.
[4] Exports.
[5] Estimate for Greece, Italy, Rumania, and Yugoslavia included in total; in addition, molybdenum ore is produced in Burma, China, Chosen, Finland, Japan, Manchuria, and U. S. S. R., but data of production are not available.
[6] Partly estimated.

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[7] Metal Bulletin (London), No. 2843, November 12, 1943, p. [illegible].

VANADIUM

By C. E. NIGHMAN and ALICE P. VAN SICLEN

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SUMMARY

In 1943 the production of vanadium-bearing ores reached an all-time high, culminating an upward trend that started from virtually zero in the depression year 1933. The industry was stimulated by the improved business conditions of 1937 and received further impetus from the outbreak of war in Europe, particularly after the entrance of the United States into the conflict. The 1943 production peak was more than five times that of 1917, when the vanadium content of mined production first reached a million pounds, and represented about 60 percent of the estimated world production.

Although vanadium contained in ores imported in 1943 was about 370,000 pounds (15 percent) less than in 1942, the available new supply mounted about 10 percent. Consumption of domestic and foreign ores was relatively unchanged. Stocks of vanadium in all forms increased so satisfactorily that allocation controls were removed by the War Production Board on December 30, and about a month later the Metals Reserve Co. announced termination of the Government ore-buying program.

Salient statistics of the vanadium industry in the United States, 1940–43, in pounds of vanadium contained

	1940	1941	1942	1943
Mine shipments of ores and concentrates [1]	2,162,916	2,513,051	4,439,130	5,586,492
Imports:				
Ore or concentrates	2,574,951	2,138,608	2,422,376	2,052,620
Vanadium-bearing flue dust	([2])	([2])	154,028	64,393
Exports of ore, concentrates, and vanadium oxide	([2])	25,462	22,140	38,180
Consumption [3]	2,162,916	2,393,478	3,914,673	5,179,290

[1] Measured by receipts at mills and Government purchasing depots.
[2] Data not available.
[3] Domestic ores only.

POST-WAR OUTLOOK

The post-war course of vanadium consumption will be related closely to the demand for engineering steels. In peacetimes, use is highly concentrated within a few industry groups. Wartime expansion in the heavy-duty machinery field has resulted in an accumulation of much equipment that may be utilized for peacetime production.

Probably the greatest normal use for vanadium is for cutting and high-speed tools. The peacetime volume of these goods was increased severalfold by total-war demands. The automotive and railway-equipment industries represent the remaining large consumption areas. Here there is a great potential market. However, scrap and surplus armament will afford a prolific source of secondary metal. The resultant of these various depressants on the use of new supplies points toward a short-term decline below the immediate pre-war consumption level while overhanging surpluses of basic vanadium products and fabricated or partly fabricated goods are being consumed. Beyond that time an expansion of use is anticipated.

WAR REGULATIONS

War Production Board allocation control of vanadium, which had been in effect since December 20, 1941, was lifted on December 30, 1943, by amendment to General Preference Order M-23-a. However, vendors of more than 500 pounds of vanadium (ferrovanadium and commercial vanadium pentoxide) in any one month were required henceforth to report all sales to the War Production Board. Under General Imports Order M-63 the Government had complete control over vanadium imports.

The restrictions imposed by W. P. B. order M-21-h on the use of vanadium in melting alloy tool steels were removed in January 1944, thereby allowing producers of alloy steels to use any alloy content desired, except that they were required to employ 50- to 60-percent alloy scrap in all melts. Revocation of General Limitation Order L-223, early in January 1944, removed W. P. B. restrictions on the distribution, sale, and use of hard-facing alloys containing vanadium and certain other metals.

Price-control regulations are given in the section on Prices.

Sales of vanadium for laboratory and experimental purposes are exempt from the provisions of the regulation, as is the importation of processed materials. However, their resale is subject to the same maximum prices as domestically produced materials.

Because of the vertical integration of the industry and virtually complete concentration of ferrovanadium production in the hands of two companies, the Office of Price Administration believed price control could be achieved most fully at that stage of production. Therefore, ores and concentrates, both foreign and domestic, have been specifically exempted from these provisions of the regulation.

This regulation incorporated without change the standards and specifications that have been used by industry.

PRICES

More than 80 percent of vanadium consumption is in the form of ferrovanadium. From the beginning of production in this country (about 1907) to the outbreak of the First World War, ferrovanadium prices were irregular but substantially below the high average of 1919-21 of above $4.50 per pound of contained vanadium. Prices dropped abruptly about $1.00 in 1922 and declined gradually thereafter to $2.60-$2.80 for the usual commercial grades at the end of 1932. In 1933, prices recovered to $2.70-$2.90 and remained stable thereat until the autumn of 1941, when the producers agreed informally with the Office of Price Administration not to increase the prices without notice to that agency. This arrangement was succeeded by the General Maximum Price Regulation of April 28, 1942, which froze prices at the levels then existing. These ceiling prices in turn became fixed specifically, under the terms of Maximum Price Regulation 489, effective November 8, 1943, which also set prices on tungsten, molybdenum, cobalt, and certain other alloys and metals.

Following are the established maximum prices per pound of contained vanadium in *ferrovanadium*, for standard crushed sizes, f. o. b. Niagara Falls, N. Y., or Bridgeville, Pa., freight allowed to destination for 25 pounds or over:

Grade	Analysis			Prices	
	Percent V (minimum)	Percent Si (maximum)	Percent C (maximum)	Contract	Spot
A—Open Hearth	30	12.00	3.50	$2.70	$2.80
B—Crucible	35	4.00	1.00	2.80	2.90
C—Primos	35	1.50	.20	2.90	3.00

Premiums per pound of contained vanadium for crushing or grinding to sizes smaller than the standard may be added.

Maximum prices per pound of contained V_2O_5 in vanadium pentoxide, for air-dried or fused vanadium pentoxide, f. o. b. Niagara Falls, N. Y., or Bridgeville, Pa., with freight allowed to destination on 25 pounds or over, were established at:

(1) Maximum base contract price, any quantity	$1.10
(2) Maximum base spot price:	
500 pounds and over	1.15
Less than 500 pounds to 10 pounds	1.20
Under 10 pounds	1.25

Premiums per pound of V_2O_5 contained for crushing or grinding to sizes smaller than the standard may be added.

Maximum prices for other vanadium products (metal and metal powder, silicide, chloride, sodiumorthovanadate, ammonium metavanadate, and other vanadium alloys and compounds consumed principally by the metallurgical industry) are the highest prices charged or quoted for such products during January, February, or March 1942 to a purchaser of the same class.

An upward trend in prices paid for vanadium ores was noted in the Minerals Yearbook review of 1942. The average reported for 1943 showed a further advance of 4 cents to about 35 cents per pound of contained vanadium pentoxide. This was largely the effect of a full year's buying program, a substantial share of which was for Government account (Metals Reserve Co.), at somewhat above the earlier free market prices. Trade-journal quotations are nominal and have been listed at 27½ cents since 1935. However, private buyers have purchased upon a sliding-scale basis that depended principally upon the V_2O_5 content with a minimum close to 2 percent. Before the United States entered the present conflict, prices (delivered buyers' works) reported to the Bureau of Mines ranged from about 18 to 35 cents and more for the various standard grades and classes. The bulk of purchases was between 18 and 25 cents. No consideration is here given to content of uranium, which has a limited market and is frequently too low to be commercially recoverable. In 1942–43, in order to stimulate production, especially by small operators, the Metals Reserve Co. not only purchased ores normally unacceptable because of low grade or refractory nature but set prices virtually on a single-lot basis, giving consideration to the higher labor and supply costs and to the length of haul to purchase depots or processing plants. No fixed purchasing schedule was effective, but from incomplete reports to the Bureau delivered prices appear to have been approximately 50 to 75 percent above the pre-war levels.

UNITED STATES

MINE PRODUCTION AND TREATMENT OF ORES

The 1943 record-breaking mine output of vanadium ores and concentrates containing 9,975,878 pounds of V_2O_5 (5,586,492 pounds of V) was in great measure attributable to the policies made effective by the Metals Reserve Co. Its agents, the United States Vanadium Corporation and the Vanadium Corporation of America, through their long experience and skill in mining, ore purchasing, and processing, contributed greatly to the success of the intensive production program.

The principal policy invoked was that of price incentive (see section on Prices), to which the response was marked. Until Metals Reserve Co. entered the ore-purchasing field in 1942, mine output was heavily concentrated in the hands of a small group of operators and their lessees. With increased prices offered at the mine and concurrent relaxation of the usual minimum quantity and grade requirements, the number of what may be termed "independent" or small operators recorded by the Bureau of Mines for 1943 rose to 216. The number of like respondents rarely exceeded 20 in the past. The small-mine group furnished slightly more than half the Government-account purchases of over 4,300,000 pounds V_2O_5, and the remainder was supplied by 4 major operators. The distribution of small-lot production, by size of operation, is shown in the subjoined table.

Distribution of small-mine production (shipments), by size of operation, in pounds of vanadium pentoxide [1]

Pounds V_2O_5	Operators		Production		
	Number	Percent of total	Total pounds V_2O_5	Percent of total	Cumulative percent of total
Under 1,000	71	32.9	30,000	1.3	1.3
1,000-2,499	49	22.7	80,000	3.4	4.7
2,500-4,999	16	7.4	58,000	2.4	7.1
5,000-9,999	27	12.5	186,000	7.9	15.0
10,000-14,999	17	7.9	212,000	8.9	23.9
15,000-19,999	8	3.7	131,000	5.5	29.4
20,000-29,999	11	5.1	262,000	11.1	40.5
30,000-39,999	10	4.6	341,000	14.4	54.9
40,000-100,000	4	1.8	202,000	8.5	63.4
Over 100,000	3	1.4	865,000	36.6	100.0
Total	216	100.0	2,367,000	100.0	

[1] Includes about 158,000 pounds delivered to private mill operators.

This tabulation illustrates the size of individual deposits and indicates the need of systematic examination and exploration to provide reserves of carnotite and "roscoelite," the ore types that heretofore have been the source of nearly all domestic vanadium.

Although there was a considerable range in grade of ore—from 1.6 to 2.5 percent V_2O_5—for the different groups, there was no apparent correlation between size of operation and tenor. The average grade (1.8 percent V_2O_5) was slightly lower than that of ore shipped by the mill operators. The decline in grade of ore mined cannot be defined with precision from year to year, but over the long term it has been notable. In the First World War period—1915–19—it averaged about 30 pounds vanadium per short ton of ore (2.7 percent V_2O_5) compared with 20 pounds (1.8 percent) in the current war period, 1940–43.

As usual, Colorado led with 74 percent of the United States total production (vanadium content), followed by Utah with 15 percent and Arizona with 4; the remaining 7 percent originated in Idaho, Nevada, and New Mexico. In 1942, the distribution of vanadium production between ore types was: The so-called "roscoelites," 17 percent; carnotites, 77 percent; and others, 6 percent. In 1943 the percentages were 22.5, 74, and 3.5, respectively. Of interest was the expansion of mining in the Navajo Indian Reservation in northern Arizona and New Mexico. The principal independent Arizona producer was Wade, Curran & Co., which sent its ore to the Government treatment plant at Durango, Colo.

The following table shows total production by the major and smaller producers, by States. Owing to the difficulty of obtaining reports from all mine operators, some of whom are lessees from the major producers, mine production is here reported in terms of receipts at processing plants and purchasing depots.

Vanadium ores and concentrates produced in the United States in 1943, by States, in pounds of V_2O_5

State	Pounds	Value [1]
Arizona	404,054	$142,772
Colorado	7,428,267	2,610,207
Utah	1,488,715	523,117
Other [2]	654,842	242,397
	9,975,878	3,518,493

[1] Apportioned upon basis of estimated value of total production.
[2] Idaho, Nevada, and New Mexico.

At a meeting of the Vanadium Industry Advisory Committee of W. P. B. on October 25, 1943, it was stated[1] that restrictions on the use of vanadium might be eased. Production had exceeded consumption since the first of the year, and the stock-pile goal of 3 million pounds of ferrovanadium was in sight.

More specifically, allocations during the preceding 12 months had totaled 3,633,000 pounds (contained vanadium), and consumption was 3,550,000 pounds. At the end of August total stocks were 2,062,000 pounds, of which the Government held 948,000 pounds and industry 1,114,000 pounds. Consumers' average stocks for the preceding 6 months had been 415,000 pounds. Up to October 15 Metals Reserve Co. had received 2,562,776 pounds of ferrovanadium having a metal content of 1,153,386 pounds. In view of the satisfactory position, the committee recommended minimum stocks of 2 million pounds of vanadium in ferrovanadium or vanadium pentoxide, or about 6 months' supply at the estimated requirements for the first two quarters of 1944.

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[1] Daily Metal Reporter, vol. 43, No. 231, December 4, 1943, p. 2.

A few days after the aforementioned meeting, the Production Executive Committee of W. P. B. announced its policy with respect to restricting marginal mineral production and related matters. The major factors that influenced the Board to take action were the increased mineral production, revised military requirements, and a greater need for marginal manpower than for marginal minerals. With respect to the alloying elements (vanadium, molybdenum, tungsten, cobalt, and others) the Board decided that when stock piles reached the recommended levels, production and imports would be kept in balance with consumption. To that end, arrangements were made to reduce Government purchases of certain ferro-alloy minerals. Further, no new contracts would be entered into for the purchase of foreign vanadium.

Since a material share of domestic vanadium production was of a marginal nature, as related in preceding paragraphs, domestic producers were forewarned of the subsequent action taken by Metals Reserve Co., which notified the industry that the Government-supported purchase program would be terminated February 29, 1944. After that date the processing plants at Durango, Gateway, and Monticello were closed down but kept in stand-by condition.

The treatment plants named below were in operation during 1943. The Blanding (Utah) plant, destroyed by fire in 1942 and rebuilt early in 1943, was operated for a short time only. Most of the owners' ore output was sold to Metals Reserve Co. Near the end of the year the Rifle plant treated some Metals Reserve Co. ore. At Durango a 100-ton acid-leach plant was put into operation to recover values from current and accumulated tailings. At Uravan, a new 250-ton unit began production late in July.

Location	Ownership	Operated by—	Capacity per day (short tons)
Colorado:			
Cedar	Private	No. Continent Mines, Inc	25
Durango	Defense Plant Corporation	U. S. V. Corporation (M. R. C. agent)	100
Gateway	Private	do	20
Grand Junction	do	U. S. V. Corporation	30
Naturita	do	Vanadium Corporation of America	75
Rifle	do	U. S. V. Corporation	200
Uravan	do	do	300
Utah:			
Blanding	do	Blanding Mines Co	25
Monticello	Defense Plant Corporation	Vanadium Corporation of America (M. R. C. agent).	100

In addition to the foregoing, the Anaconda Copper Mining Co. produced vanadium oxide at Anaconda, Mont., from phosphate rock mined in Idaho, and Mammoth-St. Anthony, Ltd., sodium vanadate from complex ores at its Tiger, Ariz., plant. Foreign ores and concentrates were treated at Bridgeville and Canonsburg, Pa., and vanadium was recovered as a byproduct at Glens Falls N. Y.

EXPLORATION AND DEVELOPMENT

In the Second World War period severe drafts have been made on our native resources. In terms of vanadium contained in ore mined, the output in the 4 years 1940–43 equaled that from 1918 through 1939 and was almost 42 percent of the total known historical (1900–1943) production of approximately 37 million pounds.[2] The unique American-owned Peruvian deposits have been materially depleted.[3] Other major world suppliers are South-West Africa and Northern Rhodesia. The former has not been able to show an enlarged output under the spur of war demand and partial State support. The latter remains the British Empire's principal source and cannot be expected to enlarge its current deliveries greatly, although reported to have large reserves.[4]

The properties imparted to iron and steel by vanadium additions give it high rank among the alloy elements. It is of general utility in low alloys and is considered an essential constituent of high-speed tool steels, high-strength cast irons, and steel forgings, and therefore has an important place in peacetime and a strategic one in wartime industrial production. The relative scarcity of commercially workable deposits, their concentration in a few hands, and their already indicated depletion brought about an intensive search for vanadiferous materials suitable at least as a secure emergency reserve. In the United States, by far the greatest consuming nation, these efforts appear to have been fruitful.

The potential vanadium reserves in the extensive phosphate beds of the Wyoming-Idaho area, which were disclosed as a result of studies begun by the Geological Survey in 1939, were explored further by the Bureau of Mines and the Survey, as well as by the Metals Reserve Co., operating through its agent—the Wyodak Coal & Manufacturing Co.[5] The results of field and laboratory work indicate that it may be possible to mine the raw material and recover both V_2O_5 and a phosphatic fertilizer at costs not widely divergent from those of current practice in this country. Elsewhere in Wyoming the Bureau of Mines investigated titaniferous magnetite deposits and crude oils as potential sources of vanadium.

Field studies of vanadium in sandstones of the Colorado Plateau, begun in 1939 by the Geological Survey in cooperation with the State of Colorado, were expanded in 1943 to include parts of Utah and the Carrizo Mountains in Arizona and New Mexico; preliminary geologic maps of the Placerville district, San Miguel County, Colo., were released. The drilling program of the Bureau of Mines approximated 40,000 feet on 40 different properties in southwestern Colorado and southeastern Utah. Ore-testing facilities of the Bureau were utilized in analyzing and treating specimens of vanadium-bearing materials from Arizona, Colorado, Nevada, Oregon, Utah, Washington, and Wyoming.

Exploration by diamond drilling was conducted by the Bureau on vanadium-bearing flake graphite ores in the Ashland district of Alabama, and laboratory tests were run to determine the economic possibilities of vanadium recovery from the material.

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[2] Includes byproduct recovery from phosphate rock and complex Arizona ores.

[3] Minerals Yearbook, 1942, p. 671.

[4] See footnote 3.

[5] The principal vanadium-bearing layer in the phosphate measures has a reported V_2O_5 content of about 1 percent, which is about three times that of the high-grade phosphate rock mined by the Anaconda Copper Mining Co. and is apparently somewhat better than that of the large Peruvian asphaltite deposits.

Results of an earlier investigation by the Geological Survey of the vanadium-bearing magnetite deposits in northern New York were published.[6] The following statement has been abstracted therefrom.

> Four deposits of vanadium-bearing magnetite-ilmenite, closely associated with small intrusive bodies of gabbro in the anorthositic core of the Adirondack Mountains, have been found near Lake Sanford, Essex County, N. Y., at the head of the Hudson River.
>
> The ore consists of intermixed granular ilmenite and magnetite, with a little rutile and varying proportions of silicate minerals. The magnetic concentrate from the ore may contain * * * up to 1.7 percent V_2O_5 possibly in very fine-grained coulsonite, an iron-vanadium oxide, which is included in the magnetite. Three metals can be produced from the ore—iron and vanadium from the magnetite and titanium from the ilmenite.
>
> The largest of the deposits, on Sanford Hill, is now being mined by the National Lead Co. It has been proved by diamond drilling to contain, above the level of the lake, 11,500,000 tons of rich ore, which will yield 8,200,000 tons of magnetic concentrate containing, on the average, 0.6 percent V_2O_5.
>
> Another large deposit, on Iron Mountain, probably contains 7,000,000 tons of rich ore, which will yield 4,550,000 tons of magnetic concentrate with an average content of 0.7 percent V_2O_5. The district as a whole contains 16,500,000 tons of measured ore, which will yield 10,000,000 tons of magnetic concentrate with an average content of 0.6 percent V_2O_5; 12,600,000 tons of indicated ore, which will yield 8,300,000 tons of magnetic concentrate averaging 0.7 percent V_2O_5; and 13,900,000 tons of inferred ore, which will yield 2,500,000 tons of magnetic concentrate averaging 0.8 percent V_2O_5.

In the autumn of 1943 the National Lead Co., had completed pilot-mill tests and was preparing designs for a plant for the recovery of vanadium.

FOREIGN TRADE[7]

Vanadium is imported into the United States as ore and concentrates and as vanadium-bearing flue dust. During 1943 foreign ore and concentrates were imported for both private and Government account. The material received under Metals Reserve Co., contracts is subsequently converted to ferrovanadium and stock-piled. Vanadium-bearing flue dust is obtained from smokestacks and boilers of ships burning certain Venezuelan and Mexican oils and has been brought into the United States for some years, although it has been recorded in import statistics only since 1942.[8] The accompanying tables show imports of vanadium-bearing materials in 1942 and 1943, by countries, and yearly imports of vanadium ore or concentrates from 1934 to 1943, inclusive.

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[6] Balsley, James R., Jr., Vanadium-Bearing Magnetite-Ilmenite Deposits near Lake Sanford, Essex County, N. Y.: Geol. Surv. Bull. 940-D, 1943, pp. 99-123.

[7] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[8] Vanadium-bearing flue dust is also recovered from the boiler tubes and fireboxes of American flag ships after arrival at American ports. According to the American Merchant Marine Institute (New York Times, August 29, 1943, sec. 3, p. 5), the dust is packed in bags and offered to bidders, who are permitted to make chemical analyses in advance of bidding. As marketed, the material contains 12 to 15 percent. V_2O_5. Petroleum slag, a residue from processed flue dust, is also marketed in small quantity.

Vanadium ore or concentrates and vanadium-bearing flue dust imported for consumption in the United States in 1942 and 1943, by countries

Country	1942			1943		
	Pounds		Value	Pounds		Value
	Gross weight	Vanadium content		Gross weight	Vanadium content	
Ore and concentrates:						
Peru	31, 610, 284	2, 053, 399	$979, 037	18, 361, 988	1, 559, 160	$816, 401
South-West Africa[1]	4, 881, 984	368, 977	295, 446	3, 755, 143	493, 460	263, 749
	36, 492, 268	2, 422, 376	1, 274, 483	22, 117, 131	2, 052, 620	1, 080, 150
Vanadium-bearing flue dust:						
Canada	370, 217	73, 074	15, 554			
Curacao (N. W. I.)	125, 303	11, 818	9, 835	596, 246	57, 481	48, 148
Peru	128, 903	69, 136	4, 156	152, 503	6, 912	5, 405
	624, 423	154, 028	29, 545	748, 749	64, 393	53, 553

[1] Reported by U. S. Department of Commerce as Union of South Africa.

Vanadium ore or concentrates imported for consumption in the United States, 1934–43, inclusive, in pounds

Year	Gross weight	Vanadium content	Value	Year	Gross weight	Vanadium content	Value
1934	3, 507, 840	413, 952	$145, 506	1939	31, 387, 722	2, 132, 548	$991, 511
1935	952, 000	94, 080	40, 070	1940	45, 102, 004	2, 574, 951	1, 216, 705
1936	3, 734, 080	342, 720	155, 730	1941	24, 645, 686	2, 138, 608	1, 012, 991
1937	14, 806, 400	1, 258, 880	638, 799	1942	36, 492, 268	2, 422, 376	1, 274, 483
1938	19, 962, 880	1, 384, 320	891, 475	1943	22, 117, 131	2, 052, 620	1, 080, 150

As shown in the table of exports, shipments of vanadium ore and concentrates to foreign countries are small. It is more practicable to export vanadium as ferrovanadium, and in 1943 foreign shipments were 444,457 pounds of ferrovanadium valued at $518,322, most of which went to Canada. A large release to U. S. S. R., which was authorized in October 1943, did not appear as an export item until early in 1944.

Vanadium ore and concentrates[1] exported from the United States in 1941–43, inclusive, by countries, in pounds

Country	1941		1942		1943	
	Gross weight	Vanadium content	Gross weight	Vanadium content	Gross weight	Vanadium content
Australia					5, 160	1, 445
Canada	37, 150	17, 578	73, 542	22, 140	75, 438	26, 186
Iran					37, 676	10, 549
Japan	7, 470	3, 552				
Netherlands Indies	629	256				
United Kingdom	10, 422	4, 076				
	55, 671	25, 462	73, 542	22, 140	118, 274	38, 180

[1] Classed as ore and concentrates but probably also includes fused vanadium oxide.

WORLD PRODUCTION AND DEVELOPMENTS

Although information is not available as to recent production of vanadium in Northern Rhodesia and only 9-month totals are at hand for production in South-West Africa during 1942 and 1943, Peru appears to have continued as the principal foreign source of vanadium.

Canada.—As much as 5 percent vanadium is said to be present in copper ores being developed by Santiago Mines, Ltd., on Quadra Island 110 miles northwest of Vancouver.[9]

Early in the year there was introduced into the Canadian tariff law an item (retroactive to January 2, 1943) permitting duty- and tax-free entry of ferrovanadium and vanadium oxide into Canada for use in the manufacture of steel or iron.[10]

Germany.—Self-sufficiency of Germany in vanadium is indicated by Kroll,[11] who lists as probable sources the minette ores of France and Luxemburg, containing 0.07 percent vanadium; vanadium slags imported from Spigerwerk in Norway; and red mud from the Bayer process.

Emergency high-speed steels used in Germany are said to contain 4.30 percent vanadium.[12]

Japan.—Deficiency of vanadium in Japan is suggested by the lack of hardness in armor plate of captured Japanese material.

Peru.—The lowered production of vanadium reported in 1943 may indicate a step toward conservation of reserves at the Mina Ragra property. The new 200-ton plant for recovery of high-grade concentrates, construction of which was undertaken in 1942, was less than half-finished at the end of 1943. Completion of the plant has been retarded by scarcity of labor and materials. Gildemeister [13] has recently described research on vanadium by early Peruvian investigators and discussed possible future developments in the vanadium industry in Peru, using vanadiferous asphaltites as raw material.

Sweden.—Post-war interest in developing vanadium resources of Sweden was indicated by the action of six Swedish steelworks in acquiring rights to exploit potential vanadium-containing iron ore deposits in Kramstaberg, in Jarvso, northern Sweden.[14]

World production of vanadium in ores and concentrates, 1938–43, in metric tons

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Argentina	....	15	1	6	....	(1)
Mexico	101	80	32	(2)	....	....
Northern Rhodesia	374	384	368	342	[3] 350	[3] 375
Peru	826	996	1,214	1,017	[4] 1,008	855
South-West Africa	557	514	428	269	[5] 316	[5] 396
United States (shipments)	732	900	981	1,140	2,014	2,534
	2,590	[4] 2,890	[4] 3,020	[4] 2,800	[4] 3,800	[4] 4,300

[1] Data not available; estimate included in total.
[2] Less than 1 ton.
[3] Estimated by authors.
[4] Preliminary figure; subject to revision.
[5] January to September, inclusive.

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[9] Northern Miner, vol. 28, No. 52, March 18, 1943, p. 14.

[10] Foreign Commerce Weekly, vol. 11, No. 2, April 10, 1943, p. 18.

[11] Kroll, W. J., German Metallurgy in War Time: Eng. and Min. Jour., vol. 144, No. 10, October 1943 p. 83.

[12] Albrecht, C., Emergency Metallurgy in Germany: Metal Progress, vol. 44, No. 6, December 1943, pp. 1121–1123.

[13] Gildemeister, Alfonso, La Industria del vanadio y su porvenir en el Peru (paper presented at the Second Peruvian Congress of Chemistry, Lima, October 1943): Mineria Peruana, ano II, No. 18, November 1943, pp. 7–10.

[14] Foreign Commerce Weekly, vol. 14, No. 13, March 25, 1944, p. 36.

TUNGSTEN

By H. W. Davis

SUMMARY OUTLINE

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SUMMARY

Production of primary tungsten concentrates in the United States advanced for the fifth successive year to establish a new record. Domestic production of primary concentrates was 12,045 short tons (60 percent WO_3 basis) in 1943, or 28 percent greater than in the previous record year 1942. The Yellow Pine mine in Idaho, which attained first place as a producer in the United States, and the Metals Reserve Co. re-treatment plant at Salt Lake City, which began operating in April, were chiefly responsible for the gain in 1943. The importance of large mining and milling units in the tungsten industry is shown by the fact that four operators producing more than 2,000 tons each supplied 79 percent of the entire output in 1943. Notwithstanding the record production in 1943, it was equivalent to only 59 percent of domestic consumption. An important event in the tungsten industry in 1943 was the initial production in North Carolina.

As a consequence of more favorable shipping conditions, receipts of imported ore and concentrates increased 21 percent over 1942 to an all-time high of 19,524 short tons (60 percent WO_3 basis) in 1943. Of the 1943 total, China supplied 47 and Bolivia 27 percent.

Salient statistics of tungsten ore and concentrates in the United States, 1939–43, in pounds of tungsten

Year	Production [1]	Shipments from mines [1]	General imports (receipts)	Consumption	Stocks at end of year			
					Consumers and brokers	Producers [1]	Government stock pile [2]	Total
1939	3,429,047	4,080,024	3,111,629	(3)	2,667,738	283,803	144,000	3,095,541
1940	4,872,806	5,062,199	9,666,228	9,955,000	2,803,249	93,618	5,417,000	8,313,867
1941	6,420,303	6,249,945	13,152,716	16,699,000	2,404,876	263,626	8,117,000	10,785,502
1942	8,977,575	8,882,403	15,409,814	17,389,000	3,416,438	355,864	9,532,000	13,304,302
1943	11,463,467	11,358,778	18,581,009	19,313,000	2,459,246	458,586	21,058,000	23,975,832

[1] Primary concentrates.
[2] Excludes secondary concentrates and milling ore.
[3] Not available.

Consumption of tungsten concentrates also established a new peak in 1943 and amounted to 20,300 short tons (60 percent WO_3 basis), an 11-percent gain over 1942.

The supplies of tungsten ore and concentrates made available in 1943 greatly exceeded requirements; as a result, stocks at the close of 1943 were 80 percent greater than at the end of 1942. Moreover, stocks at the end of 1943 were more than a year's requirements at the rate of consumption in 1943. As a consequence of the improved supply position, the War Production Board discontinued the allocation of tungsten ore and concentrates, ferrotungsten, and certain tungsten products on December 30, 1943.

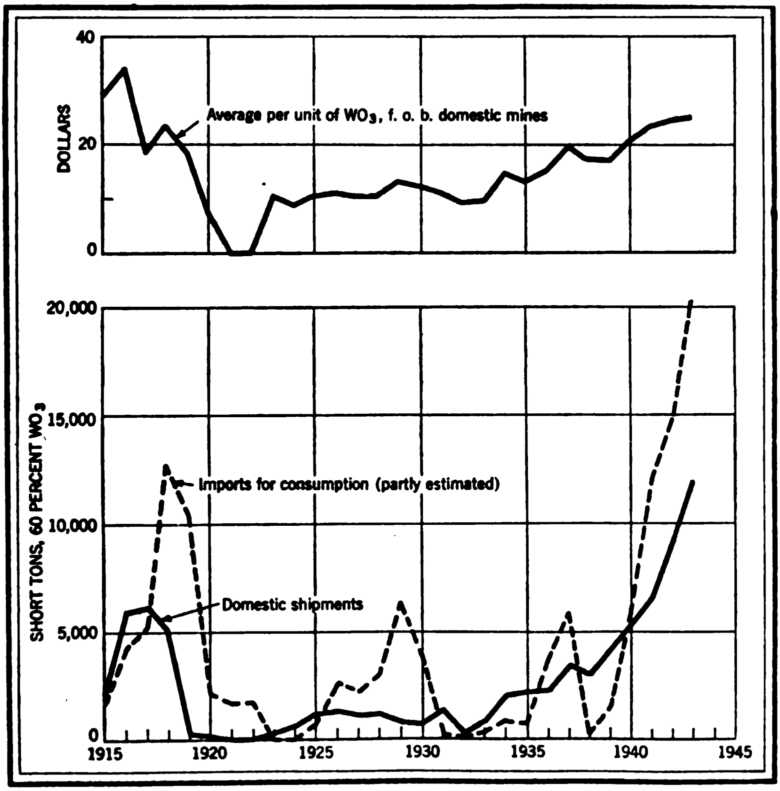

FIGURE 1.—Trends in domestic shipments, imports, and average price of tungsten ore and concentrates, 1915–43.

An excellent monograph on tungsten by Li and Wang was made available in 1943.[1]

The Bureau of Mines published a report on methods of analyzing tungsten ores.[2]

Figure 1 shows trends in domestic shipments, imports, and prices of tungsten ore and concentrates since 1915.

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[1] Li, K. C., and Wang, C. Y., Tungsten: Its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications, and Economics: Reinhold Publishing Corporation, New York, 1943, 325 pp.

[2] Peterson, H. E., and Anderson, W. L., Determination of Tungsten in Low-Grade Ores; Bureau of Mines Rept. of Investigations 3709, May 1943, 15 pp.

POST-WAR OUTLOOK

Concerning the post-war outlook for tungsten, the Engineering and Mining Journal states as follows:[3]

> The war emphasized the strategic importance of tungsten, but developed no new uses for it. The post-war outlook, therefore, is that it will recover its peacetime applications except to the extent that it has been displaced in alloy steels by other metals. Its properties are so extraordinary, however, that it is likely to grow in favor, and enjoy steady expansion in production and use. As in the past, post-war domestic production will probably be inadequate to meet home demand, and imports will be necessary.

GOVERNMENT EXPLORATION

The Geological Survey continued to expand its study and investigations of domestic tungsten deposits initiated in 1938. In 10 Western States, tungsten deposits were examined in approximately 150 areas or districts, including nearly 300 individual deposits. The Bureau of Mines continued its exploration program on tungsten deposits in Alaska, California, Colorado, Nevada, and New Mexico. The Geological Survey cooperated with the Bureau of Mines in carrying out work on these projects.

During the latter part of 1943 the newly discovered deposit of tungsten in Vance County, N. C., was explored by the Bureau of Mines. The Geological Survey cooperated with the Bureau in mapping and carrying out the work on this deposit. The exploration conducted by the Bureau in Vance County has opened an entirely new tungsten field in the Eastern States. Active exploration is now in progress on this deposit by Haile Mines, Inc., and the Lassiter Interests.

PRICES

Quotations on tungsten ore and concentrates remained steady throughout 1943. According to the Engineering and Mining Journal, Chinese, Bolivian, and Portuguese ore was quoted at $24 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, at $26 a short-ton unit. The buying price of Metals Reserve Co. for domestic ore and concentrates from "eligible" producers was $30 a short-ton unit. The average price for the domestic primary concentrates shipped in 1943, as reported to the Bureau of Mines, was $25.07 a short-ton unit of WO_3.

DOMESTIC PRODUCTION

Chiefly as a result of bringing into operation the re-treatment plant of Metals Reserve Co. at Salt Lake City, Utah, and greatly increased output at the Yellow Pine mine in Idaho, production of primary tungsten concentrates in the United States gained 28 percent over 1942 to reach an all-time high of 12,045 short tons (reduced to an equivalent of 60 percent WO_3) in 1943. The concentrates were obtained from a large number of widely scattered operations in Arizona, California, Colorado, Idaho, Missouri, Montana, Nevada, North Carolina, Utah, and Washington. However, California, Idaho, and Nevada supplied 96 percent of the total output, and four operators (United States Vanadium Corporation, Bradley Mining Co., Nevada-Massachusetts Co., and Metals Reserve Co.) produced 79 percent of the United States total. Idaho displaced California as the principal producing State in 1943.

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[3] Engineering and Mining Journal, Metals for the Alloy Steels: Vol. 145, No. 2, February 1944, p. 84.

In addition to the output of 12,045 tons of primary concentrates, 17,400 tons of secondary concentrates (11.75 percent WO_3), which require further milling, and a considerable tonnage of milling ore were produced in 1943. The bulk of these concentrates was shipped to the re-treatment plant of Metals Reserve Co. at Salt Lake City, Utah; the ore was shipped to the re-treatment plant and to various purchasing depots of Metals Reserve Co. Some of the secondary concentrates shipped to the re-treatment plant in 1942 and 1943 were treated during 1943, and the resultant primary concentrates recovered are included in the 1943 production and shipment figures.

Tungsten ore and concentrates produced and shipped in the United States, 1942–43, by States [1]

State	Produced				Shipped from mines			
	1942		1943		1942		1943	
	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units
Alaska	(2)	(2)	----------	----------	(2)	(2)	----------	----------
Arizona	209	12,531	55	3,302	219	13,141	62	3,724
California	3,495	209,702	3,867	232,011	3,483	208,961	3,871	232,238
Colorado	380	22,810	342	20,522	376	22,574	378	22,693
Idaho	2,132	127,934	4,878	292,673	2,108	126,465	4,648	278,885
Missouri	----------	----------	1	45	----------	----------	1	45
Montana	(2)	(2)	13	815	(2)	(2)	----------	----------
Nevada	3,135	188,071	2,819	169,139	3,052	183,126	2,910	174,619
North Carolina	----------	----------	47	2,798	----------	----------	40	2,388
Texas	(2)	(2)	----------	----------	(2)	(2)	----------	----------
Utah	30	1,786	21	1,248	29	1,717	21	1,248
Washington	45	2,695	2	136	43	2,590	4	234
Undistributed	7	428	----------	----------	23	1,403	----------	----------
	9,433	565,957	12,045	722,689	9,333	559,977	11,935	716,074

[1] Excludes secondary concentrates and ore produced as mill feed for Salt Lake City, Utah, mill of Metals Reserve Co. and ore produced and shipped to depots of Metals Reserve Co.

[2] Included under "Undistributed."

Tungsten ore and concentrates shipped from mines in the United States, 1939–43

Year	Quantity		Reported value f. o. b. mines		
	Ore and concentrates, 60 percent WO_3 (short tons)	Tungsten content (pounds)	Total	Average per unit of WO_3	Average per pound of tungsten
1939	4,287	4,080,024	$4,402,182	$17.11	$1.08
1940	5,319	5,062,199	6,576,318	20.61	1.30
1941	6,567	6,249,945	9,223,726	23.41	1.48
1942	9,333	8,882,403	13,508,266	24.12	1.52
1943	11,935	11,358,778	17,954,885	25.07	1.58

Alaska.—At the Riverside mine near Hyder, mining was resumed in May with a skeleton crew, and milling was started in June on a one-shift basis. During 1943 about 500 short tons of ore averaging 1 percent WO_3 were milled, from which 25 tons of concentrates averaging 10 percent WO_3 were recovered and placed in stock. Because of the low quality of these concentrates, they have been omitted from the 1943 statistics.

Arizona.—Production of primary tungsten concentrates in Arizona was 60 short tons averaging 55.03 percent WO_3 in 1943 compared with 181 tons averaging 69.23 percent WO_3 in 1942. Shipments were 65 tons averaging 57.29 percent WO_3 in 1943 and 192 tons averaging 68.44 percent WO_3 in 1942. The large decline in production and shipments was due chiefly to suspension of operations in February at the Boriana mine near Yucca, Mohave County, where output dropped from 128 tons in 1942 to 15 tons in 1943. The remainder of the output came from a number of widely scattered operations, chiefly the Black Gold mine in Pima County, Chloriding and Diff claims in Mohave County, and Maudina and Morning Star mines in Pinal County.

In addition to the primary tungsten concentrates produced and shipped in 1943, small quantities of milling ore were shipped to the Parker and Phoenix depots of Metals Reserve Co. This ore has been omitted from the 1943 statistics.

California.—After holding first place since 1940 as a producer of primary tungsten concentrates, California was displaced by Idaho in 1943. However, production was 11 percent greater than in 1942. Output of primary tungsten concentrates was 3,559 short tons averaging 65 percent WO_3 in 1943 compared with 3,324 tons averaging 63 percent WO_3 in 1942. Of the 1943 total, Inyo County supplied 74.7 percent; San Bernardino 12.6 percent; Tulare 5.8 percent; Madera 4.0 percent; and El Dorado, Fresno, Kern, Mono, Riverside, and San Diego together 1.7 percent; the source of 1.2 percent was not reported.

Shipments of tungsten concentrates from California totaled 3,569 short tons averaging 65.07 percent WO_3 in 1943 compared with 3,334 tons averaging 62.68 percent WO_3 in 1942. Although primary tungsten concentrates were shipped from a large number of widely scattered operations, 6 producers—the Atolia Mining Co. and Hoefling Bros. (in San Bernardino County), the United States Vanadium Corporation and Tungstar Corporation (in Inyo County), Haggerty & Madden (in Madera County), and Consolidated Tungsten (in Tulare County)—supplied 3,299 tons or 92 percent of the State total. The bulk of the remainder was shipped from the Garnet Dike mine in Fresno County; Schober, Tungsten City, and Marble mines in Inyo County; and Big Jim mine in Tulare County.

In addition to the primary tungsten concentrates produced and shipped in 1943, 516 short tons of secondary concentrates averaging 13.88 percent WO_3 were shipped to the re-treatment plant of Metals Reserve Co. at Salt Lake City, Utah, for further milling. A small quantity of milling ore was also shipped to the Salt Lake City mill, and small quantities of secondary concentrates and milling ore were shipped to the Fresno (Calif.) depot of Metals Reserve Co. The secondary concentrates and milling ore shipped to Salt Lake City and Fresno have been omitted from the 1943 statistics, but the resultant primary concentrates recovered will be included in later figures. The bulk of these secondary concentrates was shipped by Martin & Krebs, Tungstar Corporation, and West Coast Tungsten Co.

The largest producer in California and the second largest producer of primary concentrates in the United States during 1943 was the United States Vanadium Corporation, which operated the Pine Creek mine near Bishop and, in addition, milled some ore from the Adamson mine of Panaminas, Inc. Production of concentrates was 13 percent less than in 1942.

The Tungstar Corporation, operating the Tungstar mine near Bishop, was the second largest producer in California in 1943. Output of primary concentrates was four and one-half times that of 1942.

Hoefling Bros., who began operations December 10, 1942, at the Spud Patch Placer in San Bernardino County, made a substantial production of concentrates averaging 66 percent WO_3 in 1943. The deposit being worked is a residual placer lying below the well-known Atolia vein system. The ore consists of fragments of scheelite in a sand and gravel streak approximately 4 feet thick, covered with 6 to 30 feet of sand overburden. Mining is done with dragline power shovel. The ore is hauled 4 miles to a jigging plant for treatment.

The Harrel Hill mine in Tulare County, operated by Consolidated Tungsten, was an important producer of tungsten concentrates in 1943, as was also the new Strawberry mine in Madera County, operated by Haggerty & Madden, which began producing in September.

Production at the Atolia mine in San Bernardino County, operated by the Atolia Mining Co.—the largest producer during World War I—was at a much lower rate than in 1942.

The remaining output of primary tungsten concentrates in California in 1943 came from a large number of smaller operations, but most of it was produced by the Tulare County Tungsten Mines, operating the Big Jim mine in Tulare County; the Tungsten City Milling Syndicate, treating Tungsten City tailings, El Diablo Mining Co., operating the Schober and Brownstone mines, and Marble Tungsten Co., operating the Marble mine, all in Inyo County; and Sheridan, Bennett & Kidder, operating the Garnet Dike mine in Fresno County.

Colorado.—Production of primary tungsten concentrates in Colorado declined to 412 short tons averaging 50 percent WO_3 in 1943 from 492 tons averaging 46 percent WO_3 in 1942, but shipments (378 tons, 60 percent WO_3 basis) were slightly greater than in 1942. The 1943 production and shipment figures include 73 short tons of concentrates averaging 65 percent WO_3, which were recovered at the Salt Lake City (Utah) mill from the milling of secondary concentrates originating in Colorado.

In addition to the primary tungsten concentrates produced and shipped in 1943, Boulder Tungsten Mills (Inc.) and George H. Teal & Associates shipped 1,342 short tons of secondary concentrates averaging 8.24 percent WO_3 to the re-treatment plant of Metals Reserve Co. at Salt Lake City, Utah, for further milling. A considerable quantity of milling ore was shipped to the Nederland and Salida depots of Metals Reserve Co. during 1943. These secondary concentrates and milling ore have been omitted from the 1943 statistics, but the resultant primary concentrates recovered are included.

Most of the primary tungsten concentrates produced in Colorado in 1943 came from operations of the Wolf Tongue Mining Co. and the Vanadium Corporation of America and from milling of Colorado secondary concentrates at the Salt Lake City Mill of Metals Reserve Co.

Idaho.—Idaho attained the rank of leading producer of primary tungsten concentrates in the United States in 1943. Production again increased phenomenally and totaled 5,418 short tons averaging 54.02 percent WO_3 in 1943 compared with 2,389 tons averaging 53.55 percent WO_3 in 1942. Shipments of primary concentrates were 5,186 tons averaging 53.78 percent WO_3 in 1943 compared with 2,366 tons averaging 53.45 percent WO_3 in 1942. The 1943 production and shipment figures include 1,847 tons of concentrates averaging 65 percent WO_3, which were recovered at the Salt Lake City (Utah) mill from the milling of secondary concentrates originating at the Yellow Pine mine of Bradley Mining Co.

The Yellow Pine mine near Stibnite, Valley County, where tungsten production was begun by the Bradley Mining Co. in August 1941, was the largest producer in the United States in 1943. Although this mine was the second-largest producer of primary concentrates in 1942, its output of both primary and secondary concentrates exceeded that of any other mine in 1942. In 1943 the Yellow Pine mine produced and treated 178,747 short tons of scheelite ore averaging 2.08 percent WO_3, which yielded 3,382 tons of primary concentrates (47.60 percent WO_3) and 12,940 tons of secondary concentrates (11.57 percent WO_3). These secondary concentrates, which were shipped to the re-treatment plant at Salt Lake City for further milling, are not included in the 1943 statistics; instead, the resultant primary concentrates recovered are included. The Yellow Pine mine has been described recently by Bailey.[4]

Production of hübnerite concentrates at the Ima mine in the Blue Wing district, Lemhi County, was 43 percent greater than in 1942.

Talache Mines (Inc.) produced a small tonnage of secondary concentrates (7.81 percent WO_3) at its Atlanta Group of claims near Atlanta, Elmore County, in 1943. These concentrates, which are mill feed for the re-treatment plant at Salt Lake City are not included in the 1943 statistics.

Missouri.—A small quantity of hübnerite (45 units of WO_3) was shipped from Madison County in 1943.

Montana.—A dredge and a mill, including jigs and a magnetic separator, were put into operation in 1943 by the H & H Mines to work the gravel containing scheelite and gold in Henderson Creek, near Hall, Granite County; 601,809 cubic yards averaging 0.04 pound WO_3 per cubic yard were treated, which yielded 16 short tons of primary concentrates (52.43 percent WO_3) and 167 tons (2.34 percent WO_3) of unfinished dredge and table concentrates. The dredge commenced operation on lower Henderson Creek in untested ground where scheelite values were low. Results of testing upstream are said to show scheelite values averaging about 0.15 pound per cubic yard of gravel.

Some milling ore produced in Montana was shipped to the re-treatment plant at Salt Lake City, Utah. This ore has been omitted from the 1943 statistics.

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[4] Bailey, H. D., Yellow Pine Mine—Strategic Metal Bonanza: Compressed Air Magazine, vol. 48, No. 11, November 1943, pp. 7189–7192.

Nevada.—Nevada dropped from second to third place as a producer of tungsten in 1943. Production and shipments of primary concentrates (reduced to an equivalent of 60 percent WO_3) were 2,819 and 2,910 short tons, respectively, in 1943 compared with 3,135 and 3,052 tons, respectively, in 1942. The 1943 production and shipment figures include 120 tons of concentrates averaging 65 percent WO_3, which were recovered at the Salt Lake City (Utah) mill from the milling of secondary concentrates originating at Getchell Mines (Inc.).

The Nevada-Massachusetts Co. and affiliated companies, operating mills at Mill City, Golconda, and Toulon, were the chief producers in Nevada in 1943. The concentrating mill of the Nevada-Massachusetts Co. at Mill City was destroyed by fire on November 11; it will be rebuilt. Smaller but important producers of primary concentrates in 1943 were Nevada Scheelite, Inc., operating the Leonard mine in Mineral County; Tungsten Metals Corporation, operating the Scheelite Chief, Oriole, Everitt, and Silver Bell mines in White Pine County; and M. G. L. Mining Corporation operating the M. G. L. mine in Pershing County. The remaining production of primary concentrates in Nevada in 1943 came from a large number of smaller operations, but the bulk was produced by Lincoln Mines, Inc., operating the Tem-Piute mine in Lincoln County; Cherry Creek Tungsten Mining Co., operating the Cherry Creek mine in White Pine County; and Defense Tungsten Mines, operating the Defense Tungsten mine in Humboldt County.

In addition to the primary tungsten concentrates produced and shipped in 1943, 2,476 tons of secondary concentrates averaging 13.66 percent WO_3 were shipped to the re-treatment plant at Salt Lake City for further milling. Considerable milling ore was also shipped to Salt Lake City and to the Battle Mountain and Winnemucca depots of Metals Reserve Co. These secondary concentrates and milling ore have been omitted from the 1943 statistics, but the resultant high-grade concentrates are included. The bulk of these secondary concentrates was shipped by Getchell Mines, Inc. The remainder came chiefly from the Lincoln, Cherry Creek, M. G. L., and Star Tungsten mines.

The flotation plant of Getchell Mines, Inc., which was put into operation in August 1942, treated 92,737 short tons of scheelite ore averaging 0.415 percent WO_3 during 1943, from which 2,315 tons of concentrates averaging 13.55 percent WO_3 were recovered. The ore treated came from the company mines in Humboldt County and from the Richmond and Rose Creek mines in Humboldt and Pershing Counties, respectively, operated by W. C. Rigg.

The Rose Creek mine in Pershing County has been described by Roberts.[5]

New Mexico.—During 1943 a small quantity of milling ore was produced in New Mexico and shipped to the Deming depot of Metals Reserve Co., and a small quantity of concentrates was produced from New Mexico ore by Alloy Metals at its mill near El Paso, Tex. These quantities have been omitted from the 1943 statistics.

North Carolina.—An important event in 1943 was the initial production of 40 short tons of hübnerite concentrates averaging 70 percent

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[5] Roberts, R. J., The Rose Creek Tungsten Mine, Pershing County, Nev.: Geol. Survey Bull. 940-A, 1943, 14 pp.

WO_3 in North Carolina. The concentrates were produced by Richard and Joseph Hamme and Haile Mines, Inc. The ore milled averaged 1 percent WO_3. The deposits, which are in Vance County, were discovered by Richard and Joseph Hamme while searching for gold. During 1943 the holdings of Hamme Bros. were acquired by Haile Mines, Inc., which has plans for a modern mill of 100-ton capacity.

South Dakota.—Production of tungsten in South Dakota in 1943 comprised a small quantity of milling ore, which was shipped to the Deadwood depot of Metals Reserve Co., and 2 tons of concentrates averaging 26.33 percent WO_3, which were shipped to the re-treatment plant at Salt Lake City, Utah. These quantities have been omitted from the 1943 statistics.

Utah.—Production of high-grade tungsten in Utah was 20 short tons averaging 62 percent WO_3 in 1943 compared with 33 tons averaging 54 percent WO_3 in 1942. Shipments were also 20 tons averaging 62 percent WO_3 in 1943 compared with 30 tons averaging 57 percent WO_3 in 1942. The high-grade tungsten was produced in Beaver, Box Elder, and Tooele Counties.

In addition to the high-grade tungsten produced and shipped in 1943, a considerable quantity of milling ore was shipped to the re-treatment plant at Salt Lake City for further milling. This ore has been omitted from the 1943 statistics, but the resultant high-grade concentrates recovered will be included in later figures. Most of this ore was produced at the Desert mine in Juab County, Star Dust and Traction Lode mines in Tooele County, Scheelite Queen in Millard County, Lone Pine mine in Box Elder County, and Garnet mine in Beaver County.

The re-treatment plant of Metals Reserve Co. at Salt Lake City began operating in April 1943 and during the remainder of the year treated 13,370 short tons of concentrates averaging 11.43 percent WO_3. The mill feed comprised chiefly secondary concentrates from the Yellow Pine mine of Bradley Mining Co. The remainder was mostly secondary concentrates from Getchell Mines, Inc. The resultant primary concentrates produced and shipped during 1943 have been credited in the statistics to Idaho, Nevada, and Colorado. The milling process has been recently described.[6]

Washington.—Discontinuing of operations by the General Electric Co. at the Germania mine near Fruitland, Stevens County, is reflected in the production in Washington, where output declined to 2 tons in 1943 (75 tons in 1942). Shipments were 3 tons averaging 67.83 percent WO_3 in 1943 compared with 73 tons averaging 35.48 percent WO_3 in 1942.

Wyoming.—Production in Wyoming comprised milling ore averaging 2.25 percent WO_3, chiefly from the Romur mine in Fremont County, some of which was shipped to the re-treatment plant at Salt Lake City and some to the Nederland (Colo.) depot of Metals Reserve Co. A car of ore was shipped to the re-treatment plant at Salt Lake City by J. M. Keahy. These quantities have been omitted from the 1943 statistics.

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[6] Mining World, Synthetic Scheelite as Produced at Salt Lake by the U. S. Vanadium Corporation: Vol. 6, No. 2, February 1944, pp. 11-15.

FOREIGN TRADE [7]

Domestic production of tungsten is inadequate for requirements, and the United States imports both tungsten concentrates and products, chiefly the former. Receipts of imported ore and concentrates established a new peak in 1943 and totaled 18,581,009 pounds (tungsten content), equivalent to 19,524 short tons of 60 percent WO_3. Although ore and concentrates were received from 13 foreign countries in 1943, four—China (47 percent), Bolivia (27 percent), Argentina (11 percent), and Brazil (6 percent)—supplied 91 percent of the total.

Imports in 1943 for consumption amounted to 19,347,600 pounds (tungsten content), equivalent to 20,329 short tons of 60 percent WO_3; China, Bolivia, Argentina, and Brazil supplied 47, 26, 12, and 6 percent, respectively, of the total.

Tungsten ore and concentrates imported into the United States, 1942–43, by countries

Country	General imports [1]		Imports for consumption [2]		
	Gross weight (pounds)	Tungsten content (pounds)	Gross weight (pounds)	Tungsten content (pounds)	Value
1942					
Argentina	5, 010, 604	2, 700, 496	4, 642, 037	2, 478, 622	$3, 248, 009
Australia	21, 677	11, 195	38, 796	20, 199	21, 035
Belgian Congo	264, 008	147, 829	264, 008	147, 829	211, 437
Bolivia	13, 361, 532	6, 739, 934	13, 463, 720	6, 778, 891	7, 617, 696
Brazil	51, 253	26, 612	51, 253	26, 612	38, 363
Canada	42, 497	8, 197	42, 497	8, 197	12, 531
China	8, 382, 385	4, 418, 500	7, 245, 936	3, 819, 599	4, 319, 209
Cuba	15, 408	7, 778	15, 408	7, 778	10, 298
Ecuador	127	63	127	63	84
Egypt	--------	--------	411, 009	218, 903	118, 325
French Indochina	548, 909	308, 025	37, 627	21, 418	19, 411
India and Dependencies	41, 157	21, 339	41, 157	21, 339	28, 118
Mexico	160, 096	79, 281	153, 903	76, 300	72, 558
Peru	433, 433	222, 272	511, 932	264, 586	332, 169
Portugal	365, 637	186, 750	456, 575	234, 107	267, 977
Southern Rhodesia	86, 925	47, 458	86, 925	47, 458	51, 380
Thailand	358, 310	204, 420	--------	--------	--------
Union of South Africa	508, 387	279, 665	280, 051	154, 569	163, 470
	29, 652, 345	15, 409, 814	[3] 27, 742, 961	[3] 14, 326, 470	[3] 16, 532, 070
1943					
Argentina	4, 058, 560	2, 093, 677	4, 498, 352	2, 335, 090	3, 241, 636
Australia	11, 107	6, 997	11, 107	6, 997	7, 795
Bolivia	11, 187, 440	5, 037, 184	11, 296, 625	5, 097, 315	6, 448, 778
Brazil	2, 239, 323	1, 150, 208	2, 239, 323	1, 150, 208	1, 572, 786
Burma	--------	--------	85, 044	44, 223	28, 398
Canada	636, 716	64, 786	636, 716	64, 786	65, 574
China	15, 457, 566	8, 696, 578	16, 067, 203	9, 028, 852	10, 577, 323
Cuba	13, 376	7, 892	13, 376	7, 892	8, 814
French Indochina	229, 820	126, 971	229, 820	126, 971	220, 627
India and Dependencies	302, 960	168, 194	302, 960	168, 194	235, 360
Mexico	1, 653, 959	351, 700	607, 969	323, 129	350, 744
Peru	1, 074, 942	553, 868	1, 084, 148	559, 104	736, 924
Portugal	622, 036	311, 211	624, 855	312, 677	490, 124
Thailand	--------	--------	188, 793	104, 188	91, 331
Union of South Africa	22, 100	11, 743	32, 481	17, 974	19, 823
	37, 509, 905	18, 581, 009	37, 918, 772	19, 347, 600	24, 096, 037

[1] Comprises ore and concentrates received in the United States; part went into consumption during year, and remainder entered bonded warehouses.

[2] Comprises ore and concentrates withdrawn from bonded warehouses during year (irrespective of time of importation) and receipts during year for consumption.

[3] In addition, 12,000 pounds containing 6,115 pounds of tungsten and valued at $7,308 were imported for smelting, refining, and export.

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[7] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

The duty on tungsten ore or concentrates is 50 cents per pound on the metallic tungsten contained therein. This is equivalent to $7.93 per short ton unit.[8]

Exports of tungsten ore and concentrates from the United States are insignificant and totaled only 2,416 pounds in 1943 compared with 15,714 pounds in 1942.

No tungsten metal was imported in 1943 compared with 4,435 pounds (tungsten content) in 1942. No ferrotungsten, tungsten carbide, tungstic acid and other compounds of tungsten, or combination containing tungsten or tungsten carbide were imported in 1942 and 1943.

Exports of metal, wire, shapes, and alloys other than ferrotungsten were 230,415 pounds in 1943 compared with 313,164 pounds in 1942. Exports of ferrotungsten were 1,032,649 pounds in 1943 compared with 266,955 pounds in 1942. Exports of sodium tungstate and tungstic acid were 1,508 and 51,703 pounds, respectively, in 1943 compared with 1,419 and 39 pounds, respectively, in 1942.

CONSUMPTION AND USES

Consumption of tungsten ore and concentrates in the United States was about 20,300 short tons (60 percent WO_3 basis) in 1943 compared with 18,300 tons in 1942. Of the total consumed in 1943, 12,300 tons or 61 percent were converted to ferrotungsten, the form in which most of the tungsten is introduced into steel. However, high-purity tungsten concentrates are charged directly to the steel bath; and 2,900 tons, or 14 percent of the total, were so used in 1943. Metallic tungsten and other tungsten products, chiefly the former, employed about 5,100 tons or 25 percent of the total ore and concentrates consumed in 1943.

The chief use of tungsten, according to quantity, is in the manufacture of cutting tools, the majority of which are made of high-speed steel containing about 18 percent tungsten, 4 percent chromium, and 1 percent vanadium—commonly known as "18-4-1". Smaller quantities of tungsten are used in numerous other types of high-speed steels. Molybdenum-tungsten high-speed steels (which contain 1 to 2 percent tungsten and 5 to 10 percent molybdenum) are being used successfully for many applications of tungsten high-speed steels. Other important uses of tungsten are in armor-piercing projectiles, bullet cores, erosion-resisting gun liners, stellite and tungsten carbide cutting tools, magnet steels, and austenitic valve steels and valve seats. Minor amounts of tungsten are used in lamp and radio-tube filaments, X-ray tubes, fluorescent lamps, and electrical contact points. Tungsten salts are used in the chemical, pigment, and tanning industries.

WORLD PRODUCTION

Because of restrictions on the publication of statistics by many governments, a record of recent production in many countries is not available.

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[8] A unit, as applied to tungsten ores, is 1 percent of a ton of tungsten trioxide (WO_3). Thus, a short-ton unit is 20 pounds of WO_3 or 15.86 pounds of tungsten (W).

World production of tungsten ores, 1937–43, by countries, in metric tons of concentrates containing 60 percent WO_3[1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
North America:							
Canada	-------	-------	4	6	32	244	716
Cuba (exports)	-------	-------	-------	(5)	(5)	7	7
Mexico	33	76	229	216	191	193	516
United States (shipments)	3,175	2,761	3,889	4,825	5,957	8,467	10,827
	3,208	2,837	4,122	5,047	6,180	8,911	12,066
South America:							
Argentina	866	1,195	1,309	1,417	1,720	2,115	2,420
Bolivia (exports)	1,802	2,530	3,337	4,183	4,353	5,606	6,932
Brazil (exports)	6	2	7	9	35	9	1,264
Chile	18	5	(2)	(2)	(2)	(2)	(2)
Peru	78	170	170	290	337	510	[3] 500
	2,770	3,902	(2)	(2)	(2)	(2)	(2)
Europe:							
France	-------	22	(2)	(2)	(2)	(2)	(2)
Great Britain: Cornwall	148	258	(2)	(2)	(2)	(2)	(2)
Italy	3	4	(2)	(2)	(2)	(2)	(2)
Norway	3	19	31	(2)	(2)	(2)	(2)
Portugal	2,069	2,810	3,851	4,858	5,834	5,220	7,316
Spain	250	215	(2)	299	504	1,475	3,088
Sweden	127	180	200	(2)	(2)	(2)	(2)
	2,600	3,508	(2)	(2)	(2)	(2)	(2)
Asia:							
Burma	7,393	7,796	9,025	(2)	(2)	(2)	(2)
China (exports)	17,895	13,387	11,580	3,118	(2)	(2)	(2)
Chosen	2,058	(2)	(2)	(2)	(2)	(2)	(2)
India, British	15	12	(2)	(2)	(2)	(2)	(2)
Indochina: Tonkin	648	545	510	392	(2)	[4] 130	(2)
Malay States:							
Federated	1,077	749	246	108	(2)	(2)	(2)
Unfederated	279	333	362	427	(2)	(2)	(2)
Netherlands Indies	(5)	(5)	2	(5)	(2)	(2)	(2)
Thailand	221	251	378	400	(2)	(2)	(2)
	29,586	(2)	(2)	(2)	(2)	(2)	(2)
Africa:							
Belgian Congo	-------	-------	-------	63	156	[3] 327	(2)
Egypt	193	(2)	-------	15	43	17	42
Morocco, French	-------	7	(2)	(2)	(2)	(2)	(2)
Nigeria	9	49	237	131	(2)	(2)	(2)
Southern Rhodesia	275	329	270	221	268	504	(2)
South-West Africa	41	48	50	24	[4] 62	[6] 81	[6] 134
Tanganyika Territory	2	5	(5)	2	(2)	(2)	(2)
Uganda	2	2	2	(2)	(2)	(2)	(2)
Union of South Africa	40	127	100	105	142	391	[6] 285
	562	(2)	(2)	(2)	(2)	(2)	(2)
Oceania:							
Australia:							
New South Wales	66	113	(2)	(2)	(2)	1,045	(2)
Northern Territory	345	515	354	320	(2)		
Queensland	110	167	107	(2)	(2)		
Tasmania	345	390	472	(2)	572		
New Zealand	28	54	49	88	79	73	(2)
	894	1,239	(2)	(2)	(2)	(2)	(2)
	39,620	[3] 38,000	[3] 40,000	(2)	(2)	(2)	(2)

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[1] In addition to countries listed, tungsten ore is produced in Japan, U. S. S. R., and Western Australia, but data on production are not available.

[2] Data not available.

[3] Estimate.

[4] January to June, inclusive.

[5] Less than 1 ton.

[6] January to September, inclusive.

Argentina.—Argentina ranks second to Bolivia as a producer of tungsten in South America. Output comes principally from the Provinces of San Luis and Córdoba; much smaller amounts are produced in San Juan, Catamarca, Mendoza, and La Rioja. Production was 2,200 and 1,923 metric tons (66 percent WO_3), respectively, in 1943 and 1942.

Bolivia.—Bolivia is the largest tungsten producer in South America. Most of the deposits are in the Departments of La Paz, Oruro, Potosí, and Cochabamba. Output (as indicated by exports) was 6,932 and 5,606 metric tons (60 percent WO_3 basis), respectively, in 1943 and 1942.

Brazil.—Heretofore an insignificant source of supply of tungsten, Brazil became an important producer in 1943 as a consequence of the recent discovery of deposits of scheelite in the Municipalities of Parelhas, Serra Negra, and São Joao do Sabogi in the State of Rio Grande do Norte and in the Municipality of Santa Luzia in the State of Paraiba. Exports were 1,167 metric tons, averaging about 65 percent WO_3 in 1943.

China.—Much information concerning the tungsten deposits of China, the world leading producer, is contained in the excellent monograph entitled Tungsten, by K. C. Li and C. Y. Wang. According to these authors, about 95 percent of the Chinese output comes from Kiangsi, Hunan, and Kwangtung, of which Kiangsi is by far the most important, contributing, as it does normally, 70 percent of China's total production. Production figures for China are not available for 1943, but 9,138 short tons (60 percent WO_3 basis) were received in the United States.

Cuba.[9]—The attempt to make a profitable production of tungsten concentrates by the Pan American Tungsten Corporation at the Lela mine on the Isle of Pines was unsuccessful, and operations were suspended. Approximately 6 tons of tungsten concentrates were produced and exported in 1943.

Peru.—In Peru, a relatively small producer of tungsten, the most important deposits are in the Departments of Ancash and La Libertad; there are other deposits in the Departments of Huancavelica and Puno. Production is estimated at 500 metric tons of 60 percent WO_3 in 1943 compared with 471 tons averaging about 65 percent WO_3 in 1942. Exports were 654 metric tons, averaging 64 percent WO_3 in 1943 and 337 tons in 1942; the WO_3 content of the 1942 exports is not available.

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[9] Ducoté, C. H., Commercial attaché, American Embassy, Habana, Cuba, Review of Commerce and Industry during 1943: Ms. Rept., March 8, 1944, p. 42.

BAUXITE AND ALUMINUM

By John H. Weitz and M. E. Trought[1]

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SUMMARY

Few people could have guessed in 1942 that the end of 1943 would witness an overabundance of aluminum for the war program. Yet, at the close of the year stocks of metal were accumulating so rapidly that cut-backs in production totaling 30 percent of installed capacity were made between December 1943 and July 1944. Such a possibility had, at best, seemed very remote during the lean months of 1942 and early 1943. Production (920,179 short tons) and consumption (877,381 tons) of primary aluminum in 1943 advanced 77 and 49 percent over 1942. The annual rate of production at the end of 1943 had risen to about 1,100,000 short tons, but cut-backs in output will cause 1944 production to drop to about 867,000 tons. Imports from Canada are expected to total about 77,000 tons in 1944, thus making the apparent total available supply of primary aluminum more than 940,000 tons. In addition, stocks in Canada (owned by the United States) of metal produced under contract with the Aluminum Co. of Canada exceeded 150,000 tons on May 1, 1944, and may total as much as 400,000 tons by the end of the year. Secondary production in 1944 is estimated at an additional 350,000 tons.

Highlights of the industry in 1943 included the following: All primary metal facilities being constructed under the War Production Board expansion program were completed; the two Defense Plant Corporation alumina plants were completed and produced alumina during the year; lime-soda-sinter units were begun at each of the four largest alumina plants to increase output from low-grade ores and by early 1944 were virtually complete; nearly all fabricating facilities being constructed under the auspices of the War Production Board were completed by the end of the year; and plans were made for the construction of three semicommercial plants designed to produce alumina from low-grade domestic materials other than bauxite.

Recovery of secondary aluminum increased 60 percent in 1943. Imports and exports of crude and semicrude aluminum in 1943 increased 21 and 203 percent, respectively, compared with 1942.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Mine shipments (6,746,528 short tons) and consumption (5,332,151 tons) of bauxite in 1943 increased 144 and 89 percent, respectively, compared with 1942. Owing to large stocks of bauxite held by private industry and Government and to curtailed consumption, it is estimated that bauxite output in 1944 will aggregate approximately 4,000,000 tons compared with the actual production of 6,980,829 tons in 1943. Imports of bauxite, placed on a B–2 shipping priority, are estimated at 400,000 long tons in 1944. Estimated requirements of bauxite by all industries in 1944 are placed at 4,750,000 short tons, slightly in excess of predicted supply. Any deficiency in supply, however, will be more than taken care of from the 4,800,000 tons of ore in stock piles as of the end of 1943. Late in 1943 restrictions on bauxite and alumina, embodied in General Preference Order M–1–h, were somewhat relaxed. Authorization to deliver restricted grades of ore to alumina and abrasive manufacturers was removed as a requirement, and the method of securing authorization for delivery to other industries was simplified.

In 1943 imports of bauxite (1,733,596 short tons, 77 percent of which came from Surinam) increased 75 percent over 1942, and exports (592,300, dried equivalent) rose 80 percent. Both the import and export totals represent new all-time records. Of the domestic and foreign bauxite consumed, the alumina industry used 89 percent; chemical, 3 percent; abrasive and refractory, 7 percent; and other industries, 1 percent. Compared with 1942 the alumina industry increased its consumption of bauxite approximately 114 percent, abrasive and refractory 10 percent, and other uses 23 percent, whereas bauxite used in the chemical industry decreased 30 percent. Domestic ore was equivalent to 74 percent and imports to 26 percent of the total bauxite consumed. Shipments from Arkansas comprised 97 percent of the total domestic output, and production in Georgia, Alabama, and Virginia rose substantially above that in 1942. The average value actually received for all grades of ore shipped in 1943 dropped 5 percent from 1942.

World production of bauxite is believed to have increased 60 percent and of aluminum 35 percent in 1943. United Nations output of aluminum and bauxite in 1942 was estimated at 70 and 79 percent of the world totals and may decline slightly in 1944.

Salient statistics of the bauxite and aluminum industries in the United States, 1941–43

	1941	1942	1943
Bauxite:			
Production (mine shipments)[1] ....short tons..	1,001,475	2,768,343	6,746,528
Value [2]	$5,358,976	$12,934,025	$32,744,109
Imports [2] ....short tons..	1,250,532	990,323	1,733,596
Exports (including concentrates)[2] ....do....	150,916	291,872	467,248
World production [3] ....do....	7,340,000	9,123,000	14,614,000
Aluminum:			
Primary production..........do....	309,067	521,106	920,179
Value..........	$100,395,000	$151,371,000	$265,380,000
Quoted price per pound [4] ....cents..	16.5	[5] 15.0	[5] 15.0
Secondary production..........short tons..	106,857	196,464	313,961
Imports..........	$3,827,543	$37,147,891	$41,365,485
Exports..........	$6,872,522	$26,948,686	$67,198,796
World production [3] ....short tons..	1,206,000	1,649,000	2,233,000

[1] Dried bauxite equivalent

[2] As shipped.

[3] Estimated.

[4] New York: 99 percent plus, pure virgin ingot, according to Metal Statistics, 1944, published by American Metal Market.

[5] Ceiling price.

BAUXITE

PRODUCTION

Another all-time high was recorded in 1943 when bauxite production and mine shipments reached unprecedented levels. Actual mine production increased from 2,914,278 short tons (dried equivalent) in 1942 to 6,980,829 tons in 1943, a gain of 140 percent. Mine shipments upon a dried-equivalent basis increased 144 percent in quantity and 153 percent in value over 1942. Production rose 150 percent in Arkansas, 18 percent in Alabama, and 140 percent in Georgia and decreased 37 percent in Virginia. No bauxite production was reported from Mississippi, although a small quantity of ore had been reported from Kemper County in 1942.

Arkansas mines in Saline and Pulaski Counties contributed 97 percent of the total domestic shipments in 1943 as compared with 94 percent in 1942. American Cyanamid & Chemical Corporation operated the Heckler, Rauch Leased, Rauch Owned, England, and Berger No. 100 mines in Pulaski County and the Townsend, Cargill, Cleveland, Fletcher, Consolidated (Gates lease), Globe No. 28, McDonald, Ozark No. 24, Ozark No. 28, and Quapaw mines in Saline County. All except the McDonald, Cleveland, Ozark No. 28, and Berger No. 100 mines were operated during 1942. The company also operated a gas-fired rotary-kiln drying plant at Berger, Pulaski County, and a similar plant at West Bauxite, Saline County. The calcining plant at West Bauxite was not operated during the year, but the company sintering plant at the same location was active throughout the year and supplied sintered ore to the abrasive industry. The Bierman property in Pulaski County, on which development was done in 1942 by Consolidated Chemical Industries, Inc., was idle throughout the year, and the Gates lease (otherwise known as the Alexander No. 2 mine) was surrendered to the lessor. Crouch Mining Co., Inc. (owned by General Abrasives Co.), mined and calcined ore from its Young mine near Bauxite, Saline County, solely for the abrasives industry. Dixie Bauxite Co. mined ore from its Dixie No. 2 mine near Sweet Home, Pulaski County, for direct sale to the aluminum industry and for the Metals Reserve Co. account. Dulin Bauxite Co., Inc., produced ore from the Harley, Reichardt, Thorpe, Penzel, Brown, and Ratcliffe mines in Pulaski County and from the Harris (Bryant) mine in Saline County. The latter property was sold to the Osage Bauxite Co. of Bryant, Saline County, on June 4, 1943. The company calcining plant near Sweet Home was active throughout the year and produced calcined bauxite for use in abrasives. Norton Co. continued operation of its Norton mine and calciner near Bauxite during 1943.

Porocel Corporation operated its plant at Berger, Pulaski County, where dried bauxite is milled, activated, and purified by magnetic separation; it also operated a new plant at the same location where low-iron activated bauxite is impregnated with anhydrous aluminum chloride for use as a catalyst in the production of high-octane aviation gasoline. The company has no mine of its own and purchases all requirements of dried ore from local producers. The old Ratcliffe open-pit mine of Republic Mining & Mfg. Co. was operated during the year to supply the Drury calcining plant of Aluminum Ore

Co. with high-grade ore, part of which was calcined for the abrasive trade and part of which was dried for consumption in alumina plants operated by the latter company. Both companies are subsidiaries of Aluminum Co. of America. At Bauxite, Saline County, Republic operated a large number of mines and two drying plants, including a large, new plant more than doubling the company drying capacity. Underground mines in Saline County operated by Republic included the following: Neilson, Section 26, Bertha, and Young. Open-cut mines included Elrod, Lantz, Section 10, Canal No. 1, Canal No. 2, Section 14, African Camp, Alexander Hill, Section 15, Lone 7th, Pruden, Pruden Extension, Poodle, Section 17, Spring Hill, Smith, Section 16, Maggie, Julia, Davis (includes underground workings), Bertha Extension, South Maud, East Maud, Middle Maud, and West Maud. Reynolds Mining Corporation became a major producer in the domestic bauxite industry in 1943, operating underground and open-cut mines in both Saline and Pulaski Counties. In Pulaski County the Sherrill and Hoekstra mines were operated as open-cuts, and in Saline County the Stuckey and Ulmer open-cut and the Hurricane Nos. 1 and 3 and Covington Nos. 4 and 5 underground mines were active during the year.

All of the aforementioned companies produced bauxite for sale directly to the alumina, chemical, abrasive, or other industries; in addition, most of them sold substantial quantities of crude ore to the Metals Reserve Co. for stock-piling and for use in the two large Government-owned alumina plants at Hurricane Creek, Ark., and Baton Rouge, La. The following companies and individuals, on the other hand, produced crude ore solely for sale on contract to the Metals Reserve Co.: Aluminite Mining Corporation (Winn, open-cut), Arkansas Bauxite Stripping Co. (Willie Thomas and McGuire, both open-cut), Fourche Mountain Mining Co. (Rauch North 20, open-cut), Hardin and Prewitt (Keenzel, open-cut), Jackson and Squire (Hoekstra-Dobbs-Illing tract, open-cut), Kenark Mining Co. (Westminster Church-Thomas-Barner-Porter tract, open-cut), Roy Prewitt (Morgan, open-cut), Pulaski Mining Co. (Burke and Nelson, open-cut), E. G. Shoffner, Receiver (Sam J. Lewis, open-cut), Sweet Home Bauxite Co. (Sweet Home, open-cut), Victory Bauxite Co. (Weiss, open-cut), and Wells Mining Co. (Wright, underground), in Pulaski County; and S. E. Evans Construction Co. (Bizzell and Fletcher-Hudspeth-Harris, open-cut), Maner Graham (Hogue-Fletcher, open-cut), Hull-Macke Bauxite Co. (Childress property, underground), Hurricane Creek Mining Co. (Cleveland-Evans, open-cut), Osage Bauxite Co. (Bryant, underground), Schafer and Haire (Martin, underground), Taff, Fleming, Dryden, and McWorkman (Rowland, underground), and P. C. Upton (Ramsey, open-cut) in Saline County. Many of this group of operators have already curtailed or discontinued operations owing to the cut-back in bauxite production and at certain operations to exhaustion or poor grade of deposits. One new company that came into the producing field early in 1944 and is expected to be a large operator during the coming year is Midwest Mines Co., which is working the Gray open-cut mine.

Mines in Alabama increased production slightly during 1943, but the rate of increase was not nearly as great as in Arkansas or Georgia. Bauxite Co. of Alabama, Barbour Bauxite Co., General Ore Co., Republic Mining & Mfg. Co., and D. M. Wilson Bauxite Co. were active in the Eufaula district in Barbour and Henry Counties during the year. The ore was sold in both crude and dried form to the alumina, chemical, refractory, and oil-refining industries. Drying plants were operated by Bauxite Co. of Alabama, General Ore Co., Chas. Lennig & Co., Inc., and Republic Mining & Mfg. Co. The drying kiln operated by Lennig is an old-fashioned rotary-drum drier fired with wood.

Bauxite shipped from mines in the United States, 1939–43, by States

State and year	Short tons					Value, f. o. b. mine, as shipped
	Crude	Dried	Calcined and sintered	Total		
				As shipped	Dried-bauxite equivalent	
Alabama and Georgia:						
1939	3,054	12,676		15,730	15,251	91,282
1940	[1] 2,646	10,463		[1] 13,109	[1] 12,747	[1] 77,575
1941	[1] 74,069	25,851		[1] 99,920	[1] 89,830	[1] 406,137
1942	[2] 112,397	60,751		[2] 173,148	[2] 155,922	[2] 904,619
1943	[1] 97,952	133,550		[1] 231,502	[1] 218,387	[1] 1,295,536
Arkansas:						
1939	111,121	252,398	41,088	404,607	405,093	2,074,954
1940	128,712	292,435	52,930	474,077	478,836	2,501,393
1941	247,898	596,708	66,564	911,170	911,645	4,952,839
1942	1,367,237	1,318,622	81,456	2,767,315	2,612,421	12,029,406
1943	5,210,856	1,947,419	106,473	7,264,748	6,528,141	31,448,573
Total United States:						
1939	114,175	265,074	41,088	420,337	420,344	2,166,236
1940	131,358	302,898	52,930	487,186	491,583	2,578,968
1941	321,967	622,559	66,564	1,011,090	1,001,475	5,358,976
1942	1,479,634	1,379,373	81,456	2,940,463	2,768,343	12,934,025
1943	5,308,808	2,080,969	106,473	7,496,250	6,746,528	32,744,109

[1] Includes Virginia.

[2] Includes Mississippi and Virginia.

In Georgia the bulk of the 1943 production was by American Cyanamid & Chemical Corporation from its Thig Pen mine in the Andersonville district, Sumter County. A small tonnage of ore was mined by the Bethlehem Co. from the Irwinton No. 1 and Toomsboro-Dixon mines near Irwinton, Wilkinson County. Republic Mining & Mfg. Co. reported a small production during the year from its mines in the Hermitage area of Floyd County. Driers were operated by Republic and Cyanamid at their respective mines, and all ore sold from Georgia (nearly all dried bauxite) was consigned to the chemical industry.

Republic Mining & Mfg. Co. continued to operate the Allen, Harris, and Lightner properties near Spottswood, Augusta County, Va., the first half of 1943. All ore was shipped crude to chemical and refractory companies.

A canvass of bauxite producers, conducted by the Bureau of Mines in November and December 1943, indicated that 1944 production would be about 4,000,000 short tons. On the other hand, production for the first 4 months of the year indicates a total annual output of only about 3,000,000 long tons or 3,336,000 short tons. Output will probably fall somewhere between these limits. Studies by the Bureau of Mines and Federal Geological Survey were continued in Arkansas and the Southeastern States during 1943.

The Bureau of Mines conducted intensive drilling operations during 1943 in both Saline and Pulaski Counties, Ark., using 20 drill rigs. The number of holes drilled and accepted for payment totaled 2,193, representing 521,921.5 feet of drilling. During the year 7,574,425 natural long tons of merchantable bauxite were delimited by drilling, in addition to 6,618,405 tons of submarginal bauxite and bauxitic clay. The average tonnage of merchantable bauxite discovered per hole was 3,453.9 and per foot drilled was 14.5, and the average total tonnage of bauxite and bauxitic clay discovered per hole was 6,471.9 and per foot drilled was 27.2. From December 1941 to January 1, 1944, the total merchantable ore discovered was 10,562,822 tons and the total submarginal bauxite and bauxitic clay 9,599,390 tons. For the entire 2-year period the average discovery cost per ton of bauxite was $0.043, including geophysics, laboratory costs, and drilling cost. Drilling and exploration were also carried on in Alabama and Georgia, and a considerable quantity of ore was discovered. Studies have shown, however, that the major reserves of presently merchantable bauxite in the United States occur in Arkansas.

In 1943 the Geological Survey continued its work in Arkansas, Alabama, Georgia, and Tennessee in examining deposits and locating and logging drill holes and in furnishing information for the war minerals reports on bauxite prepared by the Bureau of Mines. An excellent and concise summary of the geology of the Arkansas bauxite district is found on a subsurface contour map published February 1, 1944, by the Geological Survey.[3] The following excerpts from this summary are quoted:

> Deposits of bauxite and high-alumina clay are found at the base of the early Tertiary (Eocene) nonmarine sedimentary rocks of the Wilcox formation, which comprises at least 600 feet of sand, silt, clay, carbonaceous clay, and lignite. These nonmarine sedimentary beds dip gently to the southeast and lie unconformably upon an eroded surface of considerable relief developed on (1) marine sedimentary rocks of still earlier Tertiary (Paleocene) age—the Midway formation, (2) nepheline syenite—an intrusive igneous rock of Cretaceous (?) age, and (3) folded, steeply dipping, somewhat metamorphosed Paleozoic sedimentary rocks.
>
> The bauxite and the high-alumina clay were derived through the weathering of these rocks during the interval of geologic time represented by the unconformity at the base of the Wilcox formation * * *.
>
> Nepheline syenite is composed essentially of feldspars and feldspathoid minerals, which are silicates of aluminum and alkalies. The nepheline syenite of this area was weathered, under favorable conditions, to form high-alumina clay and bauxite. The clay of the Midway formation also was weathered to high-alumina clay and bauxite, but only where conditions were particularly favorable. Some of the shales in the Paleozoic rocks were likewise converted to high-alumina clay. About 50 square miles of the syenite mass was exposed to erosion and weathering in early Tertiary (post-Midway-pre-Wilcox) time, and in recent times about 14 square miles of it has been exposed to further weathering and erosion * * *.
>
> Some of the bauxite, especially the "granitic bauxite" found in some mines in Saline County, remained where it was developed and formed an irregular residual blanket on parts of the weathered syenite. However, most of the bauxite was subsequently transported, in some places only a short distance, to its present location where it was deposited as discontinuous, lenticular, nearly horizontal bodies fringing the syenite mass. These bodies may be compared with deposits of talus, soil material, alluvial fan and apron deposits, or alluvial valley fill. Closely associated with the bauxite deposits, and even more extensive, are deposits of high-alumina clay and kaolinitic clay, which are found immediately over, under and beyond the edges of the bauxite bodies.
>
> Deposition of transported bauxite of adequate quality and in amounts sufficient to form ore bodies occurred mainly at or near a change of slope or stream gradient on the old land surface. Commonly this change was at a line between hard and soft rocks (the buried contact between the syenite, and the Midway clay), and most of the ore bodies discovered in recent years have been on or close to this contact. Some bauxite, commonly in thin beds of low grade, has been found at a distance from the syenite, but bodies of ore are not to be expected far from the

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[3] Map of Arkansas Bauxite District, Pulaski and Saline Counties, Ark. (Strategic Minerals investigations preliminary map), Geological Survey, February 1, 1944. Text by R. P. Bryson and Mackenzie Gordon.

syenite. *In general, the ore bodies remaining to be discovered will be found at the base of the Wilcox formation along the buried syenite-Midway contact, in the valleys tributary to the major buried drainage valleys of the district.* (Author's note: Italics not in original quotations.)

Stocks of bauxite on hand at mines and processing plants on December 31, 1943, totaled 540,700 short tons (dried bauxite equivalent) compared with 312,259 tons (revised figure) on December 31, 1942. Stocks at consumers' plants increased from 959,082 tons at the beginning of the year to 1,705,262 tons at the end. Metals Reserve Co. stock piles contained 2,562,140 tons at the end of 1943.

CONSUMPTION

Actual domestic consumption of bauxite (as determined by special monthly consumer surveys conducted by the Bureau of Mines for Federal war agencies) totaled 5,332,151 short tons (dried bauxite equivalent) in 1943 compared with a consumption of only 2,820,525 tons in 1942. The consumption figures for both years include calcined bauxite shipped for export to American-owned abrasive plants in Canada for the manufacture of crude abrasives which are returned to the United States for final manufacture and consumption. The figures do not, however, include dried bauxite shipped from Arkansas to the Canadian aluminum industry (257,214 tons in 1943 compared with approximately 100,000 tons in 1942). Consumption of the 5,332,151 tons was as follows: Alumina industry, 4,761,049 tons (includes some ore used for aluminum chemicals); chemical, 178,892 tons; abrasive (including refractories), 352,423 tons; and cement, oil-refining, and steel and ferro-alloy industries, 39,787 tons. Consumption of bauxite "as shipped" totaled 5,497,284 tons and consisted of 2,286,757 tons of crude bauxite, 2,988,571 tons of dried ore, 211,676 tons of calcined and sintered ore, and 10,280 tons of activated ore. Of the bauxite consumed (dried-equivalent basis), 26 percent was foreign ore and 74 percent domestic. The alumina industry used 99 percent and chemicals, abrasives, cements, and other uses 1 percent of the foreign ore consumed.

Apparent domestic consumption, shown in the table below, is presented upon two different bases; and apparent consumption within the United States does not correspond with the data above, inasmuch as the calculations are based upon "shipments" to domestic plants and do not consider fluctuations in consumers' stocks.

Shipments, imports, exports, and apparent consumption of bauxite in the United States, 1939–43, in short tons

[Dried-bauxite equivalent]

Year	Domestic shipments from mines and processing plants to industry			Imports	Exports	Apparent consumption within United States	Apparent consumption, including shipments to Canada for processing[2]
	Arkansas	Alabama and Georgia[1]	Total				
1939	375,925	15,331	391,256	582,601	96,925	876,932	971,000
1940	490,107	12,995	503,102	705,098	134,462	1,073,738	1,200,600
1941	960,741	89,389	1,050,130	1,250,532	244,934	2,055,728	[3] 1,928,052
1942	2,588,637	153,663	2,742,300	990,323	329,477	3,403,146	[3] 2,820,525
1943	6,457,351	204,232	6,661,583	1,726,961	592,300	7,796,244	[3] 5,332,151

[1] Includes Virginia in 1940, 1941, and 1943 and Virginia and Mississippi in 1942.

[2] Includes exports to Canada, inasmuch as virtually all of this bauxite is shipped to American-owned plants in Canada for manufacture into crude abrasives reimported into the United States for final manufacture and consumption.

[3] Actual consumption.

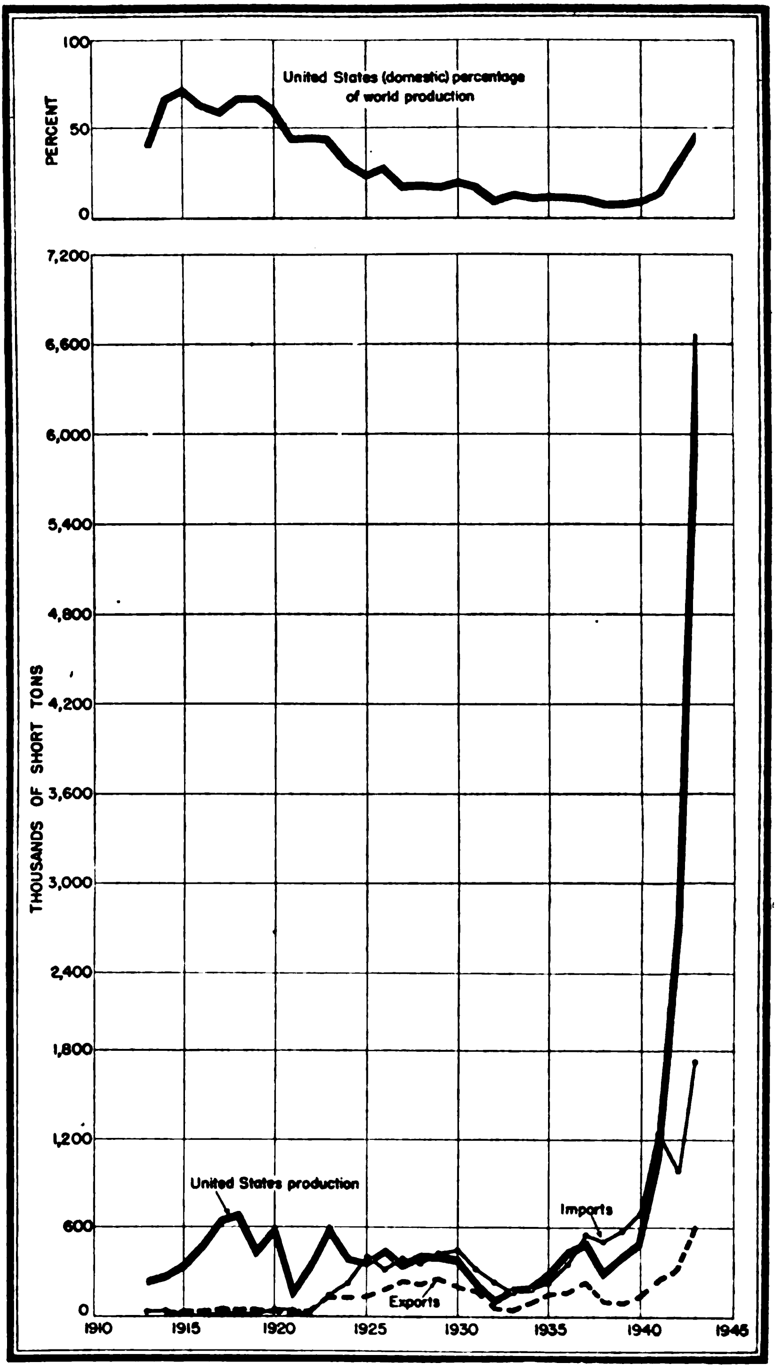

FIGURE 1.—Trends in production, imports, and exports of bauxite, 1913–43.

BY INDUSTRIES

The following table shows only shipments of domestic bauxite to consuming industries and excludes foreign ore.

Bauxite shipped from mines and processing plants in the United States, 1940–43, by consuming industries, in short tons

Industry	1940		1941		1942		1943	
	As shipped[1]	Dried-bauxite equivalent	As shipped[1]	Dried-bauxite equivalent	As shipped[1]	Dried-bauxite equivalent	As shipped[1]	Dried-bauxite equivalent
Alumina	240, 947	239, 897	618, 763	597, 607	[2] 2, 445, 365	[2] 2,266, 839	[3] 6, 804, 708	[3] 6,052, 659
Chemical	92, 735	90, 645	161, 037	158, 294	183, 804	174, 826	273, 780	270, 873
Abrasive[4]	90, 522	144, 276	148, 562	237, 980	170, 060	251, 497	199, 742	289, 387
Oil refining, refractory,[4] and other	14, 254	28, 284	51, 370	56, 249	47, 366	49, 138	43, 570	48, 664
Total quantity	438, 458	503, 102	979, 732	1, 050, 130	2, 846, 595	2, 742, 300	7, 321, 800	6, 661, 583
Total value	$3, 075, 317		$6, 155, 714		$13, 672, 727		$33, 372, 382	

[1] Includes crude, dried, calcined, activated, and sintered.

[2] Includes 672,000 tons (584,640 dried equivalent) shipped to Metals Reserve Co. stock piles.

[3] Includes 3,791,059 tons (3,195.106 dried equivalent) shipped to Metals Reserve Co. stock piles.

[4] Small quantity of bauxite shipped to makers of refractories probably included under "Abrasive."

Alumina.—Actual consumption of bauxite by the alumina industry increased approximately 114 percent over that in 1942 and comprised 89 percent of all the domestic and foreign ore used. The industry employed dried and undried ore from Alabama, Arkansas, Surinam (Netherlands Guiana), British Guiana, Brazil, and Jamaica. Estimated bauxite consumption in 1944 is expected to be about 14 percent less than that in 1943.

Abrasive and refractory.—Manufacturers of crude aluminous abrasive pigs in Canada and the United States received approximately 10 percent more domestic bauxite in 1943 than in 1942, being consigned 3 percent of all the domestic ore shipped to industry. Except for a small quantity from British Guiana, all of the calcined, sintered, and dried ore came from Arkansas. The industry's 1944 ore requirements are expected to exceed those of 1943 by about 11 percent. The use of bauxite in refractories is combined with abrasives. In 1943 the consumption of special aluminous refractory products increased substantially in the steel, glass, ship, and other industries.

Chemical.—The chemical industry consumed 30 percent less bauxite in 1943 than in 1942 and used 3 percent of all the domestic and foreign ore consumed. Shipments of domestic bauxite from mines and processing plants to the chemical industry increased 49 percent. Consumption by the industry in 1943 totaled 268,645 short tons of bauxite, but this includes ore used to make some aluminum chemicals other than those shown in the following table and does not include a large portion of the bauxite used in the manufacture of the alumina shown in the table. Ore used to make the aluminum salts and alumina shown in the table totaled approximately 298,932 tons. In addition to bauxite, producers of aluminum salts reported consuming 5,464 tons of alumina (calcined equivalent); 11,350 tons of secondary aluminum, aluminum scrap, and dross; 91,838 tons of clay; and a quantity of bichromate residues. Manufacturers estimated that their 1944 bauxite consumption will be 2 percent more than in

1943 (exclusive of a large part of the bauxite used in making alumina for the chemical and other industries).

Production and shipments of aluminum salts increased 7 and 6 percent, respectively, in 1943. Production of alumina (aside from that used in making aluminum) increased 48 percent, and shipments increased 67 percent. Of this alumina, only 6 percent was consumed by the producers of aluminum salts; the remainder was used in the manufacture of abrasives, refractories, petroleum products, spark plugs, glass, rubber, paints, and various other commodities.

Aluminum salts and alumina produced and shipped in the United States, 1942–43

	1942				1943			
	Production	Shipments			Production	Shipments		
	Short tons	Shippers	Short tons	Value	Short tons	Shippers	Short tons	Value
Aluminum salts:								
Alum:								
Ammonia	7,698	7	7,265	$497,830	11,041	6	11,292	$735,203
Potash	[1] 4,154	5	[2] 3,781	283,882	[3] 3,872	5	[4] 4,221	328,413
Aluminum chloride:								
Liquid	3,839	6	3,815	176,302	2,953	5	3,025	127,570
Crystal	16,717	3	16,578	2,714,682	[5] 21,139	3	[5] 21,464	3,696,848
Anhydrous		6				8		
Aluminum sulfate:								
Commercial:								
General	504,951	[6] 19	506,870	11,174,785	545,934	19	542,930	12,400,236
Municipal	12,940	9	12,925	204,872	12,574	9	12,750	224,680
Iron-free	22,210	9	23,331	833,378	15,821	5	16,339	665,309
Sodium-aluminum sulfate	28,404	2	29,993	1,850,200	28,977	2	30,801	2,116,769
Sodium aluminate		11				13		
Total aluminum salts	600,913	....	604.558	17,735,931	642,311	....	642,822	20,295,028
Alumina [7]	58,297	10	52,413	5,510,343	86,420	12	87,554	7,457,263

[1] Includes 73 tons made from iron-free aluminum sulfate.
[2] Includes 71 tons made from iron-free aluminum sulfate.
[3] Includes 98 tons made from iron-free aluminum sulfate.
[4] Includes 100 tons made from iron-free aluminum sulfate.
[5] Includes 395 tons made from iron-free aluminum sulfate.
[6] Revised.
[7] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, light and heavy hydrate, converted to a calcined-alumina equivalent.

Aluminum salts shipped in, imported into, and exported from the United States, 1939–43

Year	Domestic shipments		Imports		Exports			
					Aluminum sulfate		Other aluminum compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	494,032	$11,813,299	828	$22,335	34,734	$744,755	1,792	$208,455
1940	513,520	12,882,578	21	866	43,615	994,861	1,920	271,715
1941	626,384	17,382,675	(1)	231	51,261	1,184,169	2,815	349,951
1942	604,558	17,735,931	(1)	4	44,428	1,103,340	2,384	354,397
1943	642,822	20,295,028	3	941	37,946	963,151	2,922	307,288

[1] 147 pounds in 1941 and 50 pounds in 1942.

The plan of General Chemical Co. to convert its many aluminum sulfate plants from the use of bauxite as a raw material to the use of clay is now virtually complete. The calcining plant at Owensville, Mo., is in operation and calcining Missouri diasporic clays for shipment to the various alum works of the company. Some difficulty was experienced in the earlier stages of the change-over from bauxite to clay at some of the plants, but this has been largely overcome. A new producer of sodium aluminate entered the field during 1943, when the Marquette Cement Mfg. Co. began production.

Other.—Consumption of bauxite in the cement, steel and ferroalloy, and oil-refining industries rose 23 percent above the quantity used in 1942, and it is estimated that 1944 bauxite needs will exceed 1943 use by 23 percent. The use of thermally activated bauxite as an adsorbent and catalyst in the petroleum industry increased during the year and is expected to increase even more during 1944, as demand for high-octane aviation gasoline and synthetic rubber increases.

PRICES

In 1943 the average selling price, f. o. b. mines and processing plants, was $3.76 per short ton for crude (undried) bauxite, $5.45 for crushed dried bauxite, $11.45 for calcined bauxite, and $50.13 for activated bauxite. Values per long ton were as follows: $4.21 for crude, $6.10 for dried, $12.82 for calcined, and $56.15 for activated. The average value for all grades of domestic ores as shipped was $4.56 a short ton ($4.80 in 1942) or $5.11 a long ton ($5.38 in 1942).

The Metals Reserve Co. purchased bauxite in Arkansas throughout 1943 for delivery to the four stock-pile depots at Sweet Home, Ward Spur, Lignite, and Hurricane Creek. A special price schedule for these purchases was set up based upon the percentages of contained silica and alumina in the ore. The base price was $4 a long ton for bauxite containing 13 percent silica and 50 percent alumina, and a bonus-penalty system provided that (1) each percent of silica under 13 would add 20 cents to the purchase price per ton; (2) each percent of silica over 13 would deduct a penalty of 43 cents; (3) each percent of alumina under 50 would add 14 cents; and (4) each percent of alumina over 50 would deduct 14 cents a ton from the purchase price. Effective September 1, 1943, a new schedule was set up providing that all prices on the previous schedule be raised 15 cents a ton. A penalty of 43 cents a ton for each percent of ferrous iron over 6 percent was also imposed.

FOREIGN TRADE

Imports of bauxite in 1943 increased 75 percent from 1942, reaching a record total of 1,733,596 short tons, and exports (dried equivalent) increased 80 percent and totaled 592,300 short tons, also a new high mark. Of the 1943 imports, 1,342,042 tons came from Surinam, 375,213 tons from British Guiana, 16,135 tons from Brazil, 114 tons from France, 86 tons from Yugoslavia, 6 tons from Jamaica,[3] and less than 1 ton from Canada, according to the United States Department of Commerce. By customs districts importations were as follows: 1,416,036 tons to Mobile, 317,353 tons to New Orleans, 201 tons to Buffalo, 4 tons to St. Louis, 2 tons to Florida, and less than 1 ton to St. Lawrence.

Of the 1943 exports, 445,547 short tons were classified as bauxite and other aluminous ores and 21,701 tons as bauxite concentrates

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[3] Actually, according to the recipient of the Jamaica ore, approximately 2,500 tons were imported in March 1943, but this is not shown on U. S. Department of Commerce records.

(including alumina). Canada was the largest recipient of the exports, 444,503 tons of bauxite and other aluminous ores being shipped to that country; only 518 tons went to Curaçao and the Netherlands West Indies, 408 tons to Cuba, and 118 tons to Trinidad and Tobago. Bauxite concentrates (including alumina) were exported to the following countries: Canada 21,418 tons, Trinidad and Tobago 283 tons, and Mexico and Australia less than 1 ton each.

Bauxite imported into and exported from the United States, 1939–43

Year	Imports for consumption [1, 2]		Exports (including bauxite concentrates) [3]		Year	Imports for consumption [1, 2]		Exports (including bauxite concentrates) [3]	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1939	582, 600	$3, 765, 140	57, 831	$1, 117, 564	1942	990, 323	$5, 952, 451	291, 872	$5, 086, 695
1940	765, 098	4, 298, 069	91, 743	1, 542, 703	1943	1, 733, 596	10, 860, 149	467, 248	5, 575, 128
1941	1, 250, 532	7, 475, 039	150, 916	2, 773, 877					

[1] Also "alumina" as follows: 1939, 1 short ton valued at $432; 1940, 12 tons, $1,743; 1941, 67 tons, $5,544; 1942, 24,316 tons, $1,571,377; 1943, 13,857 tons, $1,108,104.

[2] Chiefly dried ore.

[3] As shipped.

ALUMINUM

PRODUCTION

Primary.—The production of 920,179 short tons of primary aluminum in 1943—77 percent more than the 521,106 tons produced in 1942—represented another all-time high mark for the aluminum industry. Output in each of the past 5 years has broken all previous records, but the mark set in 1943 probably will stand for at least the duration of the war, owing to a cut-back in production announced early in 1944. The average annual rate of production reached during December 1943 was about 1,100,000 short tons of metal. As a result of the cut-back ordered by the War Production Board, the average annual rate of production dropped steadily and in May 1944 was only slightly more than 900,000 tons and about equivalent to the June 1943 rate. Estimates by the War Production Board indicate that the rate will drop to about 810,000 tons in June and remain there for the remainder of the year. Total estimated 1944 production is 867,600 short tons—about 6 percent less than 1943 output. United States production in 1943 slightly exceeded the estimated output of the entire world in 1940.

The five aluminum-reduction plants of the Aluminum Co. of America (Alcoa) and the eight Defense Plant Corporation plants operated by Alcoa produced by far the largest share of the 1943 output. Reynolds Metals Co. was the second-largest producer from its two plants at Listerhill, Ala., and Longview, Wash. Olin Corporation was the only other producer in the field, with a Government-owned plant at Tacoma, Wash. Approximately 54 percent of the output was from privately owned facilities and 46 percent from Government-owned plants. Of the Alcoa output from privately owned plants, 42 percent was made at Alcoa, Tenn.; 21 percent at Vancouver, Wash.; 19 percent at Massena, N. Y.; 13 percent at Badin, N. C.; and 5 percent at Niagara Falls, N. Y. Of the output at Alcoa-operated Defense Corporation plants, 22 percent was produced at Queens, N. Y.; 17 percent at Mead, Wash.; 16 percent at Jones Mills, Ark.; 13 percent at St. Lawrence (Massena), N. Y.; 12 percent at Troutdale, Oreg.; 10 percent at Los Angeles, Calif.; 6 percent at Burlington, N. J.; and 4 percent at Riverbank, Calif. The Listerhill (Ala.) plant of Reynolds Metals Co. supplied 61 percent of Reynolds production, and the Longview (Wash.) plant the remaining 39 percent. The value of the aluminum shipped in 1943 averaged 14.42 cents a pound compared with 14.62 cents in 1942.

During 1943 the expansion of all primary metal plants was completed. The Queens plant came into production in March, and the Burlington and Riverbank plants started operation during May. By November 1943 all reduction plants had reached virtual capacity except for three potlines—two at Los Angeles and one at Riverbank—which were not operated owing to a labor shortage. Shortly after the attainment of this objective, it became apparent that aluminum ingot was in a position of considerable oversupply. Current needs were more than being met, and on December 31, 1943, stocks of primary ingot at reduction plants, in excess of normal, and stocks of ingot stored in Canada for Metals Reserve Co. totaled nearly 140,000 tons and were growing at a rapid rate. Accordingly, at the instance of War Production Board, curtailments were brought into effect, and in the period from December 15, 1943, to May 31, 1944, cut-backs were made totaling 30 percent of installed capacity. By plants the cut-backs were as follows: Alcoa, Tenn., 10 percent; Badin, N. C., 13 percent; Massena, N. Y., 30 percent; Burlington, N. J., 67 percent; Los Angeles, Calif., 40 percent;[4] Queens, N. Y., 100 percent; Riverbank, Calif., 33 percent;[4] St. Lawrence, N. Y., 100 percent;[5] and Troutdale, Oreg., 25 percent.[6]

The Defense Plant Corporation alumina plant at Baton Rouge, La., began producing calcined alumina in March 1943, and construction work was completed in July. At Hurricane Creek (Bauxite), Ark., construction was essentially completed on the original plant by April 1, 1943, and the first expansion of 150,000 tons a year, begun in July 1942, was completed during August 1943. The second expansion at Bauxite, authorized in March 1943, calling for an additional 127,500 tons a year was completed early in 1944. In July 1943 a further over-all expansion of alumina capacity was proposed, totaling 300,000 tons to be distributed as follows: Hurricane Creek, 50,000 tons; Baton Rouge, 150,000 tons; and Listerhill, Ala., 100,000 tons. However, this proposal was quickly shelved, as it became increasingly apparent that alumina stocks were growing and that consumption at reduction plants would be cut. Reductions in output of alumina were effected early in 1944 by the War Production Board, and by about July 1, 1944, the cut-backs will be: Mobile, 30 percent; Baton Rouge, 100 percent; East St. Louis, 27 percent; and Hurricane Creek, 30 percent. These decreases in alumina production are expected to level off supply and consumption of this commodity.

Early in 1943 construction was begun on lime-soda-sinter units at the two Alcoa and the two Defense Plant Corporation alumina plants. These sinter units were for the purpose of treating the "red mud" resulting from Bayer treatment of high-silica bauxites to obtain much of the contained alumina not recoverable by the Bayer method. At the time the sinter units were proposed and construction initiated, it appeared that the United States might have to rely almost entirely on Arkansas bauxite for the production of alumina and that the alumina plants would have to produce at capacity to supply the growing aluminum output. Actually, during 1943 it became apparent that imports of bauxite were to be quite substantial, and near the end of the year it was obvious that the formerly planned rate of alumina production could be reduced considerably. Hence the sinter units, as accessories to the Bayer plants for the purpose of extracting the last possible pound of alumina from each ton of bauxite fed into the plants, became far less vital to the aluminum industry. Nevertheless, all four units are virtually completed, and all except that at Baton Rouge are in partial operation. During 1944 it is anticipated that only about 400,000 tons of South American bauxite will be imported, and thus a larger percentage of relatively high silica domestic ore will be used than in 1943. Whether the sinter units are operated continuously during 1944 probably will depend on the cost of the alumina recovered by them and the labor required per pound of output. At present it appears that they are not likely to operate at a substantial rate in the coming year unless some unexpected demand for alumina requires that the Bayer plants operate near capacity.

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[4] Cut-backs actually represent potlines never put into production because of labor shortage.

[5] Instead of actually closing down all 3 lines at St. Lawrence, Alcoa is operating 2 of them under an agreement with Defense Plant Corporation and has curtailed an equivalent amount of production at Massena. Production of both public and private potlines is now considered as Alcoa-owned production.

[6] Curtailment here was involuntary, and potline was closed down because of a manpower shortage.

The Kalunite, Inc., alumina plant at Salt Lake City, Utah, did not produce any substantial quantities of commercial-grade alumina during 1943. As of June 1944 no predictions have been made as to when the plant will be in commercial operation. The proposed plant of Aluminum, Inc., at Marysvale, Utah, which was to have utilized a modified Moffat process in producing 18,000 tons of alumina a year from alunite, was definitely canceled in January 1944. In the fall of 1943 three small-scale semicommercial plants to produce alumina from clay and anorthosite were approved and construction was begun. The plant, to be operated by Ancor Corporation (American Nepheline Corporation), at Harleyville, S. C., will produce alumina from local clays and is expected to be in operation by early fall of 1944. Capacity will be 18,000 tons of alumina a year. At Salem, Oreg., the Chemical Construction Co. is building an 18,000-ton plant to produce alumina from clay. This plant is expected to be completed early in 1945. The third alumina plant, that of the Monolith Midwest Corporation at Laramie, Wyo., will process anorthosite and produce alumina at the rate of 18,000 tons a year starting some time in 1945.

In connection with the expansion of fabricating capacity of sheet, rod and bar, forgings, castings, and extrusions, numerous plants were constructed under the sponsorship of the Aluminum and Magnesium Division of the War Production Board during 1943 and early 1944, chiefly with Defense Plant Corporation funds. Most of these plants had been completed or at least were in partial operation by April 1, 1944.

Shortages in extrusion and rod and bar facilities which, early in 1943, constituted one of the chief bottlenecks in the expansion of aircraft production were alleviated during the latter part of the year by construction of new plants and by an easing in the labor situation. During the summer most fabricating plants experienced great difficulty with absenteeism and high quit rates and in obtaining sufficient labor. In general, the type of work was not attractive to workers because of heat in foundries and forges and because wage rates were not as high, or upgrading as rapid, as in the airplane and shipbuilding industries. An intensive recruitment drive for labor during the summer alleviated the difficulties somewhat, and by the end of 1943 and early 1944, when production cut-backs were announced, the labor problem ceased to be a major obstacle. Only in local areas, where the competitive demand for labor in shipbuilding and aircraft is high, does the situation present serious difficulties.

On April 28 the National War Labor Board awarded a wage increase of 4 cents an hour to 8,000 workers of the Bohn Aluminum & Brass Corporation. The labor dispute at the Alcoa Edgewater (N. J.) plant between employees of the remelt department and the company management was settled May 11 by an agreement giving the workers one double-time day every 6 weeks and assurance that transfers would be made as of Sundays and that additional employees would be placed on certain operations in the department. The National War Labor Board granted its first approval to an incentive pay scheme since the issuance of the "hold-the-line" order at the Lafayette (Ind.) extrusion plant of the Aluminum Co. of America on May 6. The Board's approval was subject to the provision that the plan should not increase the unit labor cost, and according to the company it will result in pay increases of about 20 percent for about 2,800 of the plant personnel of 5,000 and cause a production increase of 20 percent. A general wage increase of 4 cents an hour was granted on June 29 to 350 employees of the Fairmont Aluminum Co. at Fairmont, W. Va., under the Little Steel formula.

During early July a strike of 60 molders at the Bridgeport (Conn.) plant of Alcoa resulted in an almost complete stoppage of work. Less than a month later production was again halted by a walk-out in protest by the workers at having to purchase safety gloves for 63 cents a pair. In a move believed to be without precedent in the country, officials of the Aluminum Co. of America on July 23 commissioned employees of their Cleveland plant to reduce absenteeism and labor turn-over by their own methods. This plant has long been the focal point of much labor difficulty. On July 24 a 5-cent-an-hour wage increase was granted to all hourly employees of the Alcoa aluminum-reduction plant at Jones Mills, Ark., and of the Aluminum Ore Co. alumina plant at Hurricane Creek, Ark. Both increases were retroactive to April 1 and are based upon a similar increase granted to employees of the Republic Mining & Mfg. Co. at Bauxite, Ark., earlier in the year.

On October 19, 1943, the Supreme Court set aside for an indefinite period the Aluminum Co. of America antitrust case. The Court stated that since four justices have disqualified themselves from participating in the case it "will be transferred to a special docket and all further proceedings in it postponed until such time as there is a quorum of justices qualified to sit in it, when it will be restored to the regular docket for such further proceedings as may be appropriate." However, legislation signed by the President on June 10, 1944 (Public Law 332), provided that cases of this sort could be determined by the circuit court. The case has been sent by the Supreme Court to the Second Federal Circuit Court for final action.

Early in August a five-count indictment was returned against Bohn Aluminum & Brass Corporation and three of its officials charging them with fraud and sabotage. It was claimed in the indictment that conspiracy existed to repair and conceal defects in aluminum castings for Rolls-Royce airplane motors made by Packard Motor Car Co. The Bohn Corporation, in a formal statement, declared that the Government charges were based upon a "technical and impracticable interpretation of obsolete specifications." The company declared that "Peening and welding aluminum castings are no secret. Nor are they strange and uncommon procedures * * *."

"That we have followed a sound procedure is proved by the fact that there has never been a single engine failure due to an aluminum casting made by us." On May 12, 1944, Judge Frank A. Picard, of the Detroit Federal Court, dismissed the four charges of sabotage against the Bohn Corporation and three of its officials, leaving only a charge of conspiring to defraud the Government to be considered by the jury hearing the case.

Secondary.—Recovery of secondary aluminum in 1943 totaled 313,961 short tons compared with 196,464 tons (revised figure) in 1942 and 106,857 tons in 1941. The 313,961 tons recovered from secondary sources included 5,926 tons of pure metal (98.5+ percent), 305,357 tons of aluminum alloys, 1,279 tons of aluminum in brass and bronze, 219 tons in zinc-base alloys and 1,180 tons of aluminum in chemical products. Production in the form of secondary-aluminum ingot totaled 196,373 tons (144,694 in 1942). The secondary aluminum recovered in 1943 required the consumption of 352,124 tons of aluminum scrap, of which 34,266 tons or 10 percent was old scrap (43,248 tons or 20 percent in 1942) and 317,858 tons or 90 percent was new scrap (174,363 tons or 80 percent in 1942). Remelters, smelters, and refineries used 64 percent of this scrap; aluminum rolling mills, 35 percent; and foundries and other manufacturers, 1 percent. Additional information on secondary aluminum is given in the chapter on Secondary Metals—Nonferrous.

CONSUMPTION

Apparent domestic consumption of primary aluminum increased 49 percent over 1942. Consumption of secondary aluminum probably increased at an even greater rate.

Production, imports, exports, and apparent consumption of primary aluminum and production of secondary aluminum in the United States, 1939–43

Year	Primary aluminum					Secondary aluminum	
	Production		Imports (short tons)	Exports (short tons)	Apparent consumption [1] (short tons)	Short tons	Value [2]
	Short tons	Value					
1939	163,545	$64,600,000	9,290	36,632	167,646	53,947	$21,309,065
1940	206,280	75,292,000	17,435	26,886	227,017	80,362	29,332,130
1941	309,067	100,395,000	13,358	7,405	302,788	106,857	34,707,153
1942	521,106	151,371,000	112,112	38,747	[3] 588,969	[3] 196,464	[3] 57,446,074
1943	920,179	265,380,000	135,581	117,592	877,381	313,961	90,546,352

[1] Data not available on fluctuations in consumers' stocks. Withdrawals from producers' stocks totaled 31,443 short tons in 1939, and 30,188 in 1940; additions to producers' stocks totaled 12,232 tons in 1941, 5,502 in 1942, and 60,787 in 1943.

[2] Based upon average price of primary aluminum as reported to Bureau of Mines.

[3] Revised figures.

During the first half of 1943 a steadily growing share of total shipments went to aircraft plants, and in the latter half of the year shipments continued at approximately the same proportionate rate. About 68 percent of total shipments of fabricated products was consigned to aircraft plants for construction of airframes, landing gear, engines, propellers, and fittings. The bulk of the remainder was used in ship construction, tank engines, ordnance, and other military uses. Only a minimum of essential civilian needs, such as tools, chemical equipment, and other essential categories was filled. Pre-war uses of the metal, such as automobiles, trains, electrical conductors, furniture, household utensils, decorations, packaging, and bridge and building construction, have been virtually eliminated. However, there is some indication that during the latter half of 1944 some metal may be released for civilian manufactures in areas where both labor and facilities are available and there is a dearth of war contracts.

Consumption of aluminum in 1944 will follow a pattern similar to that in 1943 and will be at about the same rate. Aircraft construction will continue to demand the largest share of the available supply—perhaps 70 percent; Army, Navy, and Lend-Lease requirements will take most of the remainder; and essential civilian consumption will be allotted probably less than 10 percent of the total.

PRICES

Throughout 1943 the New York open-market base price of primary aluminum remained at 15 cents a pound for lots of 10,000 pounds or more, 99-percent-plus pure ingot aluminum, delivered. Deductions allowed for transportation charges on orders of 500 pounds or more cannot exceed the lowest carload rate of rail freight. Pig aluminum, first quoted late in 1942, has remained at 14 cents a pound throughout 1943 and is subject to the same transportation deductions as primary ingot.

As the result of a renegotiation agreement with the Government, the Aluminum Co. of America announced that on March 1, 1943, considerable reductions would be made in the price of fabricated-aluminum products, which ranged as high as 20 cents a pound for certain types of tubing. The lowered prices reflect savings brought about by increased output, manufacturing improvements, and continued research.

The Office of Price Administration on March 31, 1943, announced that maximum prices for pig aluminum had been set at levels 1 cent a pound below prices of corresponding-grade aluminum ingot. On June 17, in Maximum Price Regulation 2, the Office of Price Administration reduced the maximum base price of secondary-aluminum ingot by 1 cent a pound to the 14-cent level of pig aluminum to assist in continuing the normal flow of aluminum scrap from producers and dealers to smelters. In general, the regulation reduced both scrap and secondary-ingot maximum prices 1 cent per pound below the ceilings previously established. A new classification of "Wrecked Aircraft (Prepared)" was established to meet conditions resulting from the war. Prices for aircraft scrap are based upon the quantity of aluminum recovered after melting it, rather than upon the gross weight before the scrap is melted. To aid in stabilizing the market for secondary ingot, which was not able to compete favorably with

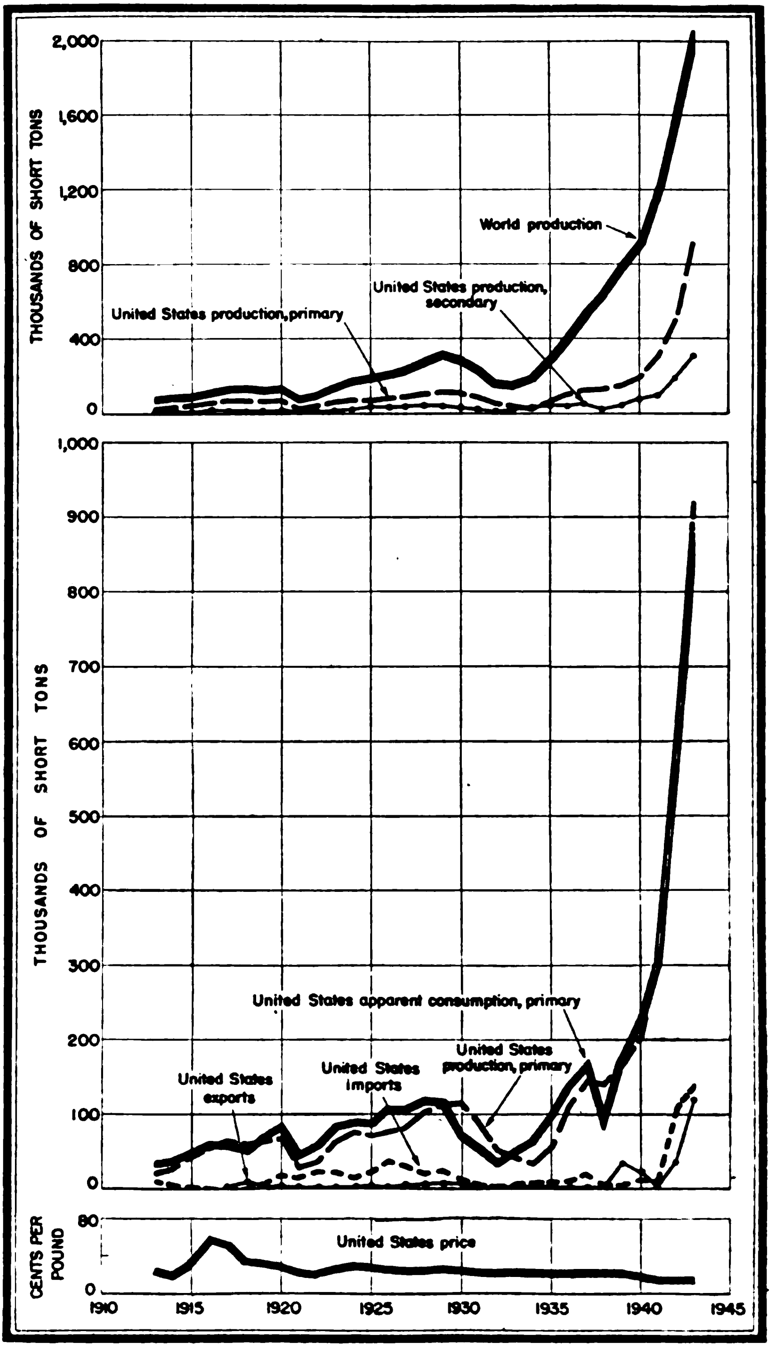

FIGURE 2.—Trends in production, imports and exports, apparent consumption, and average quoted prices of aluminum 1913–43. Price is for No. 1 virgin 98–99 percent at New York through 1929. Thereafter for 99-percent-plus virgin ingot, as reported by American Metal Market.

primary aluminum late in 1943 as total aluminum production increased and surpassed demand, the Office of Price Administration on December 18 reduced ceilings on aluminum scrap and secondary ingot at the producer level by 1½ cents a pound. The new base price for secondary ingot was set at 12½ cents a pound. Since these products had been selling at or below the newly established ceiling levels this regulation in itself resulted in no change in market prices. For the most part, the action was an assurance that a reasonable price differential between primary and secondary metal would be maintained.

FOREIGN TRADE

Imports and exports of crude and semicrude aluminum in 1943 were 21 and 203 percent more, respectively, than in 1942. The value of exports of manufactured aluminum products increased 10 percent, whereas the value of imports decreased 96 percent. Imports, exclusive of scrap, constituted 15 percent of the apparent consumption of primary aluminum in 1943. Of the imports of crude (135,505 short tons), 2 tons came from Venezuela and the remainder from Canada; of semicrude (76 tons), all came from Canada; of scrap (241 tons), 152 tons came from Canada, 58 tons from French Morocco, 21 from Canal Zone, 5 from New Guinea, 5 from Bahamas, and less than 1 ton from Belgian Congo.

Aluminum imported for consumption in the United States, 1941–43, by classes

Class	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Metal and alloys, crude	12,830	$3,333,642	106,257	$33,289,903	135,505	$41,170,788
Scrap	55	13,440	24	6,737	241	30,364
Plates, sheets, bars, etc	528	271,675	5,855	2,204,331	76	102,117
	13,413	3,618,757	112,136	35,500,971	135,822	41,303,269
Manufactures:						
Leaf (5½ by 5½ inches)	(1)	14,825				
Powder in leaf (5½ by 5½ inches)	(2)	74				
Bronze powder and powdered foil	22	28,044	(3)	4	(3)	73
Foil less than 0.006 inch thick	117	110,166	(3)	37	(3)	36
Table, kitchen, hospital utensils, etc	2	3,620	(3)	91	4	7,253
Other manufactures	(4)	52,057	(4)	1,646,788	(4)	54,854
	(4)	208,786	(4)	1,646,920	(4)	62,216
Grand total	(4)	3,827,543	(4)	37,147,891	(4)	41,365,485

[1] 11,113,500 leaves; equivalent in pounds not recorded.
[2] 50,000 leaves; equivalent in pounds not recorded.
[3] Less than 1 ton.
[4] Quantity not recorded.

Of the crude aluminum exported in 1943 (56,741 short tons), 40,141 tons went to U. S. S. R., 11,929 to the United Kingdom, 3,516 to Canada, 550 to Australia, 425 to Brazil, 104 to China, 62 to Mexico, 7 to Chile, 6 to Argentina, 1 to Algeria, and less than 1 ton to Belgian Congo, Cuba, Peru, and Trinidad; of semicrude (60,851 tons), 26,972 tons went to U. S. S. R., 18,609 to United Kingdom, 8,940 to Canada, 5,756 to Australia, 289 to China, 123 to New Zealand, 33 to Union of

South Africa, 22 to Brazil, 17 to Mozambique, 17 to Northern Rhodesia, 16 to Egypt, 16 to India, 14 to Turkey, 7 to Peru, 5 to Bahamas, 4 to Southern Rhodesia, 3 to Anglo-Egyptian Sudan, 2 each to Honduras, Costa Rica, and Colombia, 1 each to Trinidad and Syria, and less than 1 ton each to Mexico, Guatemala, Canal Zone, Cuba, Bermuda, Nigeria, Portugal, Ecuador, Curaçao, Palestine and Trans-Jordan, Nicaragua, Chile, Iceland, Surinam, Belgian Congo, Gold Coast, British Honduras, Venezuela, Iran, and Madagascar; and of scrap (14 tons), all went to Canada.

Aluminum exported from the United States, 1941–43, by classes

Class	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Ingots, slabs, and crude	750	$325, 218	17, 834	$5, 514, 562	56, 741	$19, 111, 522
Scrap	57	22, 352	32	1, 157	14	3, 216
Plates, sheets, bars, etc	6, 655	4, 445, 018	20, 913	14, 046, 933	60, 851	39, 959, 659
	7, 462	4, 792, 588	38, 779	19, 562, 652	117, 606	59, 074, 397
Manufactures:						
Tubes, moldings, or other shapes	367	550, 606	3, 398	5, 406, 137	4, 131	4, 593, 838
Table, kitchen, and hospital utensils	298	281, 851	138	161, 806	32	54, 342
Foil	274	246, 259	129	121, 800	576	474, 605
Powders and pastes (aluminum and aluminum bronze) (aluminum content)	239	206, 776	1, 314	651, 802	2, 794	1, 402, 940
Other manufactures	(1)	794, 442	(1)	1, 044, 489	(1)	1, 598, 674
	(1)	2, 079, 934	(1)	7, 386, 034	(1)	8, 124, 399
Grand total	(1)	6, 872, 522	(1)	26, 948, 686	(1)	67, 198, 796

[1] Quantity not recorded.

TECHNOLOGIC DEVELOPMENTS

Probably the most important technologic development during 1943 and early 1944 is the commercial production of alumina from relatively low-grade bauxite. The lime-soda-sinter process mentioned in Minerals Yearbook, 1942, is being successfully used at three of the large alumina plants in the United States and permits recovery of a substantial proportion of the alumina formerly lost in the red-mud residues from the Bayer process when lower-grade ores were used. Before 1940 it was believed that bauxites containing more than 5 to 7 percent silica could not be efficiently treated because of the high loss of alumina. Now, however, ores containing up to 13 percent silica are being effectively used. Low-grade bauxite is put through the regulation Bayer process, and the alumina available to solution by the hot caustic liquors is dissolved out and subsequently precipitated; but the red mud, formerly diverted to waste piles, is now taken to large calcining kilns, mixed with soda ash and lime, and sintered. Following the sintering process the sodium aluminate is leached from the sinter and is precipitated from solution as alumina in the same manner as from the original Bayer liquors. The lime-soda-sinter units do not increase the intake capacity of the alumina plants, but by making it possible to recover more of the alumina contained in the bauxite they increase the alumina output of the plant when relatively low-grade ores must be used. Several future possibilities for this method of recovering alumina which is "locked up" with silica in red mud are indicated. Aside from being used to treat residues from current operations of the Bayer process, it may be used directly on old piles of red mud accumulated in former years, especially at the East St. Louis plant of Aluminum Ore Co. Also, it may be used directly in treating low-grade bauxites without putting them through the conventional Bayer digestors, or it may be used in extracting alumina from high-alumina clays.

Commercial and semicommercial plants are being constructed to produce alumina from alunite, clay, and anorthosite. At Salt Lake City, Kalunite, Inc., has completed its plant to extract alumina from Marysvale alunite by a sulfuric-acid leaching process, although no commercial production has as yet been realized. At Harleyville, S. C., Ancor Corporation is building a plant wherein clay will be treated by a limestone-sinter soda-leach process. Clay and limestone will be crushed together and calcined, releasing carbon dioxide from the stone. The sintered product will be leached with sodium carbonate and filtered to give a filtrate of sodium aluminate. The filtrate then will be treated with the carbon dioxide recovered from the calcining kiln to precipitate aluminum trihydrate. An ammonium sulfate process for producing alumina from clay will be used in a plant now under construction at Salem, Oreg. In this process clay and ammonium sulfate are calcined at approximately 400° C. resulting in the formation of anhydrous ammonium alum and ammonia gas, collected as the carbonate or hydroxide. The calcine is leached with warm water slightly acidified by sulfuric acid to prevent hydrolysis, and ammonium alum is crystallized after the iron has been reduced with sulfur dioxide. The alum is purified by recrystallization and converted to aluminum hydroxide by treatment with the ammonium hydroxide or carbonate recovered in the first step. Ammonium sulfate is recovered from this step and reused for treatment of more clay, and the precipitated aluminum hydroxide is calcined to alumina. At Laramie, Wyo., a plant is under construction to utilize the lime-soda-sinter process in the recovery of alumina from anorthosite.

The Bureau of Mines is investigating several processes for the production of alumina and aluminum sulfate at its various experiment stations. At College Park, Md., the lime-soda-sinter process for the recovery of alumina from clays, anorthosite, and high-silica bauxite is being developed further and studied; at College Park and at Tuscaloosa, Ala., work is in final pilot-plant stage for production of iron-free aluminum sulfate used in the production of a catalyst in the Houdry 100-octane gasoline process; at Norris, Tenn., pilot-plant studies are nearly complete on the production of alumina and ferrosilicon from high-iron bauxites; at Salt Lake City, Utah, further investigations are being carried out on the ammonium sulfate process to be used in the Salem (Oreg.) plant; at Boulder City, Nev., studies are continuing on the recovery of alumina and potassium sulfate from alunite; and at Rolla, Mo., investigation of an acid process for recovery of alumina from high-iron clays is under way.

The continuous casting process of the Aluminum Co. of America, which has been under development for several years, is proving to be of vital importance in the production of large ingots for sheet, plate, bar, and extrusions.[7] Molten metal is poured at a controlled rate into a mold where freezing begins, the ingot being continuously withdrawn from the mold while freezing and cooling are completed. Metal structure obtained by this method is said to be finer and more suitable for subsequent operations than that in ingots cast by older methods. High cost and elaborate installations required are justified by present-day volume production.

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[7] Kempf, L. W., Nonferrous Physical Metallurgy: Min. and Met., February 1944, vol. 25, No. 446, p. 104.

Research on the technique of manufacturing small aluminum and aluminum-alloy pieces of high strength and accurate configuration from aluminum powders made by atomization has shown the desirability of employing a mixture of the alloy ingredients rather than prealloyed powder.[8]

Numerous patents were granted during 1943 covering many fields, including protection of surfaces and finishes, cleaning of finishes, bonding rubber and plastics to aluminum, manufacture of refractories from bauxite, aluminum halide and bauxite catalysts, and aluminum sulfate preparation. Many patents also were obtained on recovery of alumina from low-grade bauxite and other aluminous ores and on the manufacture of new aluminum alloys.

WAR MEASURES

In the second quarter of 1943 the Controlled Materials Plan became effective in transitory stage and on July 1, 1943, the former horizontal allotment system—the Production Requirements Plan—was completely replaced (for aluminum, copper, and steel) by the new vertical allotment system. Under the Controlled Materials Plan, requirements for critical materials are adjusted to the available supply through claimant agencies, and the plan provides for the availability at the proper time and place of the quantity and type of materials required to meet approved programs.

During the year Order M–1–i, restricting the uses of aluminum, was subjected to three revisions—on March 13, October 28, and December 4. The effect of the first revision was to tighten slightly the restrictions placed on the metal. Later in the year the order was revised twice in the direction of loosening restrictions, in view of the easier supply situation. Army and Navy uses of the metal were greatly broadened to allow its consumption in any combat matériel. Civilian restrictions were eased to permit use of aluminum in electrical condensers, data-instruction plates, electric motors, foundry equipment, internal-combustion engines, machine-tool attachments, refrigerating and heating coils and fins, scientific and safety equipment, collapsible tubes, trucks, busses and trailers, and other items. On January 25, 1944, the War Production Board announced a new policy permitting the use of aluminum for post-war experiments. Requests for small quantities of aluminum will be granted, provided the experiments can be carried out without diverting manpower, technical skills, or facilities from activities connected with the war effort; all grants of materials in application of the new policy will be carried out within the provisions of order M–1–i.

Full control of anhydrous aluminum chloride to assure proper flow of the material to war consumers was announced by War Production Board in General Preference Order M–287. The purpose of the order is to conserve aluminum and chlorine; it provides that no one may deliver anhydrous aluminum chloride except as specifically authorized or directed by the Director General for Operations.

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[8] Cremer, G. D. and Cordiano, J. J., Formation of Aluminum and Aluminum Alloys by Powder Metallurgy: Metal Ind., August 27, 1943, pp. 132–135.

On December 2, 1943, the War Production Board removed the requirement to secure authorization covering delivery of restricted grades of bauxite to manufacturers of alumina or abrasives, or covering delivery of alumina to manufacturers of aluminum or abrasives. The method of securing authorization to deliver bauxite and alumina to persons intending to use them for other than the above purposes was also simplified. With the issuance of General Preference Order M-1-h, as amended, the person desiring specific authorization to accept delivery of restricted bauxite or alumina is required to send his order to the Aluminum and Magnesium Division of the War Production Board, together with a statement of the specific purpose for which the material is to be used.

Restrictions on aluminum paint embodied in Supplementary Order M-1-g, as amended, were relaxed on December 24, 1943. Seven permitted uses of aluminum paint were specified for which no approval of purchase orders is needed. The amended order also forbids the sale of aluminum pigment in amounts of more than 2 pounds and aluminum paint and ink more than 1 gallon to anyone who cannot give a priority of AA-5 or higher. This will permit retailers to dispose of their present stocks in small quantities.

POST-WAR OUTLOOK

Now that aluminum is being produced in more than adequate quantities to satisfy all war needs, attention in the industry is turning increasingly toward the position aluminum will take among the family of metals in the post-war world. With a capacity equivalent to seven times the 1939 production, the aluminum industry must find and keep many new or expanded peacetime outlets if it is to utilize all or even part of the new facilities constructed since the onset of the war. Complex problems will face the industry and the Government at the war's end—disposition of the Government-owned facilities for producing alumina, aluminum ingot, and fabricated products; handling of excess stocks of primary and secondary metal, scrap, and "pipe-line aluminum," all the way from bauxite mines to aircraft factories. A major problem to be reckoned with is the obsolete scrap, which will probably be returned in the form of wrecked aircraft and other damaged battle equipment after the war.

The major influence on the post-war consumption of aluminum will be price. Throughout its history aluminum has shown a downward price trend, and since the period of war preparation the price has dropped from 20 cents a pound to 15 cents a pound in four stages. Pig aluminum is now only 14 cents a pound. With the basic policy of the industry one of lowering prices as fast as technologic advances permit so that the metal can enter new and expanded fields, the post war period may witness further substantial reductions of price. Another influence tending to increase the quantity of aluminum used in peacetime products will be the increased number of workers who will know the technique of casting, forming, and assembling the basic products of aluminum into commercially useful articles.

Civilian aircraft construction after the war, as yet an unknown factor, could consume large quantities of the metal (warplanes are now about 75 percent aluminum by weight). Decrease in weight of automobiles is predicted after the war, much of the reduction to be accounted for by substitution of aluminum in engine blocks, motors, body panels, and other parts. It has been suggested that as much as 500 pounds of aluminum per automobile could be used, including both primary and secondary metal. Highway trucks, streamlined trains, boats, and other forms of transportation are potentially large users of aluminum.

The following table shows the uses of aluminum by industries for selected months during the war years and an estimate after the war:

Uses of aluminum [1]

[In percentage of total use]

	November 1939	December 1940	May 1942	Estimate after war
Transportation (land, air, and water)	29	40	63	34
Cooking utensils	14	6	1	10
Electrical conductors	10	5		8
Machinery and electrical appliances	15	9	6	12
Building construction	8	5	3	9
Chemical	5	5	5	5
Foundry and metal working	4	23	19	9
Ferrous and nonferrous metallurgy	5	4	2	4
Food and beverage	6	2		5
General miscellaneous	4	1	1	4

[1] Metals, vol. 14, No. 1, July 1943, p. 13.

WORLD BAUXITE AND ALUMINUM INDUSTRIES

Production and consumption of aluminum reached a new high mark in 1943 because of the tremendous demand for military aircraft by the various warring nations. It is expected that this production record will not be greatly exceeded, if at all, in 1944, inasmuch as the various expansion programs are believed to be virtually complete.

World production of bauxite, 1939–43, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1939	1940	1941	1942	1943
Australia	820	[2] 1,000	1,000	[2] 4,000	[2] 5,000
Brazil (exports)	18,279	82	14,365	12,397	76,761
France	[2] 800,000	[2] 700,000	[2] 700,000	[2] 650,000	[2] 700,000
Germany	[2] 20,000	[2] 20,000	[2] 25,000	[2] 25,000	[2] 25,000
Gold Coast		(1)	[2] 15,000	[2] 45,000	[2] 160,000
Greece	186,906	[2] 50,000	[2] 50,000	[2] 50,000	[2] 25,000
Guiana:					
British	483,653	634,510	1,089,833	[2] 1,175,000	[2] 1,930,000
Netherlands (Surinam)	511,619	615,434	1,198,900	[2] 1,245,000	[2] 1,670,000
Hungary	485,000	[2] 647,000	[2] 1,000,000	[2] 1,200,000	[2] 1,200,000
India, British	9,121	[2] 15,000	[2] 25,000	[2] 30,000	[2] 30,000
Indochina	330	118	[2] 1,000	[2] 1,000	[2] 1,000
Ireland		(1)	[2] 40,000	[2] 100,000	[2] 110,000
Italy	483,965	[2] 530,000	[2] 600,000	[2] 400,000	[2] 300,000
Jamaica					[2] 2,500
Japan	[2] 39,000	[2] 43,000	[2] 50,000	[2] 75,000	[2] 80,000
Netherlands Indies	230,668	274,345	171,821	[2] 160,000	[2] 250,000
Portuguese East Africa	180	1,030	[2] 1,000	[2] 1,000	[2] 1,000
Rumania	10,460	[2] 40,000	[2] 40,000	[2] 40,000	[2] 40,000
Southern Rhodesia			[2] 1,000	[2] 1,000	[2] 1,000
Spain		271	1,393	(1)	(1)
Unfederated Malay States: Johore	93,737	63,787	[2] 75,000	[2] 75,000	[2] 60,000
U. S. S. R.	[2] 270,000	[2] 300,000	[2] 250,000	[2] 275,000	[2] 350,000
United States (dried-bauxite equivalent)	381,331	445,958	908,525	2,511,385	6,120,315
Yugoslavia	318,840	[2] 290,000	[2] 400,000	[2] 200,000	[2] 120,000
	[2] 4,344,000	[2] 4,671,500	[2] 6,658,800	[2] 8,276,000	[2] 13,257,600

[1] Data not available.

[2] Estimated production. Estimates by the authors.

World production of aluminum, 1939–43, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1939	1940	1941	1942	1943
Canada	90,718	99,064	192,594	304,631	[1] 455,000
France	50,000	[1] 59,000	[1] 62,200	[1] 70,000	[1] 55,000
Germany	[1] 210,000	[1] 240,000	[1] 300,000	[1] 350,000	[1] 350,000
Hungary	1,500	[1] 2,800	[1] 5,000	[1] 5,000	[1] 10,000
India	----	----	----	[1] 500	[1] 1,000
Italy	34,200	[1] 40,000	[1] 50,000	[1] 45,000	[1] 34,000
Japan	23,000	[1] 35,000	[1] 65,000	[1] 90,000	[1] 110,000
Norway	31,000	[1] 28,000	[1] 18,000	[1] 22,000	[1] 17,000
Spain	[1] 800	271	[1] 700	[1] 800	[1] 1,000
Sweden	2,700	[1] 2,000	[1] 2,500	[1] 2,000	[1] 3,000
Switzerland	28,000	[1] 31,000	[1] 25,000	[1] 25,000	[1] 25,000
U. S. S. R	[1] 73,000	[1] 75,000	[1] 55,000	[1] 55,000	[1] 70,000
United Kingdom	25,000	[1] 28,000	[1] 35,000	[1] 50,000	[1] 57,000
United States	148,400	187,100	280,383	472,737	834,768
Yugoslavia	2,400	[1] 2,800	[1] 3,000	[1] 3,000	[1] 3,000
	[1] 720,700	[1] 830,000	[1] 1,094,400	[1] 1,495,700	[1] 2,025,800

[1] Estimated production. Estimates by the authors.

World production of bauxite is estimated to have reached approximately 13,257,600 metric tons in 1943—60 percent more than in 1942 and about three times as much as in the pre-war year 1939. Of the world output in 1943, it is thought that the production in Axis-dominated or controlled territories was 2,801,000 tons or 21 percent of the total and that 10,456,600 tons or 79 percent was under United Nations control.

The aluminum produced in 1943 is estimated to have totaled 2,025,800 metric tons—35 percent more than in 1942 and 181 percent more than in 1939. Of the world output in 1943, it is thought that the production under the control or domination of the Axis in Europe and the Far East was 608,000 tons (30 percent), and under total United Nations control 1,417,800 tons (70 percent).

REVIEW BY COUNTRIES

Argentina.—High-alumina clays containing about 41 percent alumina are reported in large quantities from southern Argentina, near Trelew in Chubut Territory.

Australia.—It was announced late in 1943 by the Ministry of Supply and Shipping that the Commonwealth Government had decided to set aside £A3,000,000 for the establishment of an aluminum industry in Australia. The Victoria Mines Department has done some drilling in the Boolarra district, and two deposits—near Mirboo North in South Gippsland, 80 miles from Melbourne and 20 miles from the state hydroelectric plant at Yallourn—have been recently tested by the Controller of Minerals Production.

At Lake Campion, Western Australia, is an alunite deposit of an unusual type which has created a great deal of interest. It is a lake filling containing not less than 2 million, and probably more than 10 million, tons of alunite mud which is approximately 60 percent alunite. A plant has been constructed using the mud for the recovery of potassium and sodium sulfates at the rate of 5,000 tons a year. The residue from this plant, consisting of 46 percent Al_2O_3 and 37 percent SiO_2, is to be tested for the recovery of alumina in a pilot plant being built at Welshpool.

Brazil.—Latest reports are that the 6,000-ton alumina plant and 2,000-ton aluminum plant at Saramenha, near Ouro Preto, Minas Gerais, being built by the Companhia Electro-Chimica Brasileira, will be in operation during the spring of 1944. The output of this plant at capacity will be about 20 percent in excess of Brazil's normal domestic demand for the metal. Plans for the construction of the 20,000-ton reduction plant near São Paulo, which was to have been jointly financed by Brazilian and United States capital, have apparently been abandoned until after the war owing to difficulties in obtaining needed construction materials. A third plan for a plant at Campos in the State of Rio de Janeiro is forging ahead under direction of a newly organized aluminum company; but this plan likewise will have to wait till after the war for fruition. Brazil is a potentially large producer of aluminum, with its vast bauxite resources and sources of hydroelectric power. Bauxite exports from Brazil in 1943, though small by comparison with potential reserves, increased greatly and were 76,761 metric tons compared with 12,397 tons in 1942.

British Guiana.—Exports of bauxite by the Demarara Bauxite Co., Ltd., and the Berbice Co., Ltd., totaled 1,901,393 long tons in 1943, of which 1,488,858 tons went to Canada, 389,790 to the United States, 22,734 to the United Kingdom, and 11 to Trinidad. The past year has been the most prosperous to date for the bauxite-mining industry, but it is expected that 1944 production and exports will be only about half as large. On January 26, 1944, shipping schedules for the United States and Canada for 1944 were set at 400,000 tons on a B–2 priority and 1,200,000 tons on an A–2 priority, respectively. Imports into Canada and United States probably will be divided equally between British and Netherlands Guiana (Surinam). On February 17, 1943, the governor assented to a bill passed by the Legislative Council amending the Excess Profits Tax Ordinance of 1941 by extending its application to individuals and companies engaged in mining operations. The mineral most affected by the ordinance is bauxite, and in order that this ore might not be disproportionately taxed, another ordinance was assented to on the same day removing the export duty of 20 cents (British Guiana currency) a long ton and reapplying the general export duty of 1½ percent ad valorem.

Canada.—Early in 1943 aluminum, bauxite, and cryolite were placed under formal allocation. Although aluminum had been under direct control since August 1940 the new order called for strict regulation of the movement of the metal and further restrictions on the end-uses of the material. During the year, however, the situation became increasingly easier, and the supply of metal exceeded the demand by the year's end. In January 1944 restrictions on the use of aluminum were relaxed, and the metal may now be sold to the general commercial trade when used in making aluminum rivets, cast-aluminum welding rod, aluminum welding wire, aluminum metallizing wire, and aluminum wire for anodizing tie wire for electrical conductors. Except for such quantities as may be reserved for the Controller, any person may acquire or use aluminum powder or paste as a pigment in making paint. An indication of the way in which both Canadian and United States aluminum production has outstripped demand is that on December 31, 1943, over 60,000 tons of metal were held at the five Canadian reduction plants in the name of the Metals Reserve Co. (United States) and that by March 31, 1944, this quantity had more than doubled in spite of the shut-down of many potlines in United States plants. In addition to this stockpiled material, the exports of aluminum from Canada to the United States totaled 135,503 short tons during 1943. Mr. C. D. Howe, Minister of Munitions and Supply, announced in March 1944 that a reduction in the price of aluminum sold by the Aluminum Co. of Canada, the sole producer, had been effected by agreement between the company and the government. The new price also applies to purchases by the United Kingdom and the United States, but the amount of price reduction was not specified.

China.—According to reliable sources, bauxite was known at Poshan, Shantung, and southern Liao Ning before 1940. Since that time similar occurrences have been found in Yunnan, Szechuan, Kweichow, and Fukien. The most important of these fields is the one in central Kweichow, which contains ore low in silica and iron and high in alumina (65 to 75 percent). The analyses of this ore indicate that a large part of the alumina is in monohydrated form, probably as boehmite, and that the bauxite may be of the terra rosa type. It is thought that most of the bauxite so far discovered in China is of the terra rosa type, whereas that in Fukien belongs to the lateritic type.

Gold Coast.—Production of bauxite in Gold Coast reached a total of over 160,000 metric tons in 1943, far exceeding previous expectations and nearly quadrupling the 1942 output. All exports of this ore are destined to the United Kingdom for use in aluminum production. Production and exports of ore during 1943 indicate that transportation difficulties, which retarded output in 1941 and 1942, have been overcome.

Cuba.—Several preliminary surveys were made in Cuba to determine whether the same type of bauxite exists there as in nearby Jamaica. Reconnaissance indicated that large deposits of this ore probably are not present at the surface, as in Jamaica. Material similar in appearance to the Jamaica ore has proved to be nearly as high in silica as in alumina.

Greece.—The bauxite mines of the Eliopulos Metal Works near Amphissa are reported to have been taken over by the Hansa Leicht Metal Co. and are producing 3,000 metric tons monthly for export to German and Italian aluminum plants.

Haiti.—The Reynolds Mining Corporation announced early in 1944 that exploration in Haiti had revealed bauxite deposits of considerable size and that the Reynolds concern had been granted a concession by the Haitian Government to mine bauxite and other aluminum ores for 60 years. The Haitian ore is said to have different physical properties from American and Guiana bauxite now being used for aluminum production and is very low in silica. It has been named "lescotite" after President Lescot of Haiti by the Reynolds geologists. According to the company, the richest deposit of bauxite was found in the southern peninsula of Haiti, 3 miles from a seaport. It is believed that the ore found here is similar to the recently discovered Jamaica bauxite, which is characteristically low in silica, high in iron, and moderately low in alumina (40 to 50 percent). No announcements have been made as to when these Haitian deposits will be exploited.

Honduras.—Bauxite deposits reported near the Rio Patuca, Department of Colon, have proved to be clay deposits containing at least as much silica as alumina.

Hungary.—According to German reports, the aluminum plant at Ajka will start operations in 1944. This plant, which is being built by Magyar Bauxitbanya R. T. and Incandescent Lamp, Ltd., was to have begun production in 1942 and is designed to produce 20,000 tons of alumina and 10,000 tons of aluminum a year. Ungarische Allgemeine Kohlenbergbau, A. G., of Budapest, has enlarged its carbide and ferrosilicon plants as well as the aluminum works at Felsögall. The company also has opened new mines in Iszkaszentgyörgy and in Nagyvaszonypuszta. Early in 1943 Bauxitproduktions A. G. was formed, with a capital of 1,000,000 pengö, for the purchase and lease of bauxite mines and for research relating to bauxite and other products. The Hungarian press reported late in 1943 that the Bakonyer Bauxite Co., Ltd., formed in 1941 with Swiss capital, will increase its capital from 200,000 to 480,000 pengö. The company has bought all shares of the Aluminum Chippis Industry Co., Ltd., the main shareholder. On the occasion of the 75th birthday of the Hungarian regent, Admiral Horthy, 2,000,000 aluminum coins of the value of 5 pengö each were put into circulation. Previously the only aluminum coins in the country were of the value of 1 and 2 pengö and have been in circulation since 1941.

India.—The Aluminum Production Co. of India, Ltd., at Alwaye, Travancore, is reported to be in continuous commercial production, and the output of aluminum ingot is said to be sufficient to cover wartime requirements in the country. The successful production of aluminum marks the first new large-scale metallurgical development to materialize in India since the outbreak of war and also the completion of works which will rank among the major industrial enterprises of recent years. Aluminum-alloy castings are already being produced on a fairly large scale. With increasing industrialization in India, especially the development of the automobile and aircraft industries and shipbuilding, a heavy peacetime demand for aluminum should be created.

Italy.—Since the invasion of Italy, certain Italian alumina and aluminum plants have fallen into the hands of the Allies, but these plants are small compared with the larger works in the north of Italy, which as of June 1944 are still in the hands of the Axis. At Bussi sul Tirino near Popoli in Pescara Province, the 1,000-ton reduction plant owned by the Societa Alluminio Veneto Anonima (S. A. V. A.) and the 1,500-ton alumina plant of the Societa Industrie e Mineraria e Electrochimiche have presumably been captured by the Allies. A larger alumina plant owned by Societa Prodotti Chimici Nazionale at Aurelia near Civitavecchia has also been captured. (Both latter plants are subsidiaries of S. A. V. A.) No information is available as to the condition in which these plants were found, but it is reasonable to assume that they were damaged as much as possible within the limits of time available to the Germans in their retreat, if indeed they had not already been damaged by Allied air attacks before their capture.

Bauxite deposits have also fallen into Allied hands in Italy, but the bulk of the best-grade bauxite used in aluminum manufacture is found far to the northeast in the Istrian Peninsula, in the Province of Gorizia to the north of the peninsula, and on the islands of Cherso and Lussinpiccolo in the Adriatic Sea adjacent to the peninsula. The bauxite in the areas captured by the Allies is located in Aquila Province (estimated reserves, 6,000,000 tons), Benevento Province (estimated reserves, 2,500,000 tons), and in Foggia, Bari, and Lecce Provinces (estimated reserves, 4,500,000 tons). The bauxite found in Aquila and Benevento is used in normal times for the manufacture of chemicals and abrasives, but in the compartimento of Puglie the ore is used for the manufacture of aluminum.

It is reported that the expansion program of the Societa Edison (Milan), which included the erection of reduction plants at Ferrara and Mantua, has been seriously slowed by scarcity of materials, transportation difficulties, and the generally disturbed state of the country.

Jamaica.—Plans for production of bauxite in 1943 did not materialize on a large scale. A shipment of ore made in the spring of 1943 was tested by an American company and found to be too high in iron oxide to be of value in the production of alumina under present operating conditions. In the face of the relatively easy bauxite situation in Canada and the United States, resulting in the cut-back of production in the Guianas, it is unlikely that any large developments will take place in Jamaica, at least for the duration of the war. Early in 1944 Jamaican Bauxite, Ltd., was formed as a fully owned subsidiary of the Aluminum Co. of Canada, Ltd.

Japan.—The Manchurian Light Metal Co. has reportedly raised its capital from 80,000,000 to 200,000,000 yen and proposes to enlarge its Kwantung aluminum works substantially as well as to resume construction, suspended in 1939, of its plant at Antung. The Showa Co., which produces the largest share of aluminum in Japan, claims to have developed new production methods whereby a 40-percent saving in coal and a 50-percent saving in electric power will result, Recent reports state that the aluminum plant at Takao, Formosa. was bombed in January 1944.

It is very likely that the importation of bauxite into Japan has become more difficult in the latter part of 1943 and the first half of 1944 as American submarines have taken a mounting toll of shipping from the Netherlands Indies. Probably the continued air bombardment of Ponape and Palau in the Carolines has materially cut down imports from those islands as well.

Norway.—In July 1943 the Heroya aluminum plant being constructed by the Germans was bombed just as it was coming into production. Damage is said to have been so severe that the plant cannot be rebuilt until after the war. Of the original ambitious German plans to boost Norwegian aluminum capacity to 244,000 tons and alumina capacity to 202,000 tons, it is believed that only a small part remains. Plans are thought to have been abandoned at all but the projected Sandasjoen alumina plant (85,000 tons annual capacity) and the Tyin aluminum plant (24,000 tons annual capacity). Original Norwegian alumina capacity was about 36,000 tons of metal and 22,000 tons of alumina. Factors contributing to collapse of the Nazi plans were noncooperation of Norwegians, labor troubles and sabotage of machinery, and difficulties with the processes. Inability to obtain some of the necessary equipment from Germany may also have played a part in the failure.

Spain.—The capacity of the Sabinanigo plant of Soc. General Espanola de Aluminia is reported to have been raised to 2,700 metric tons annually. No information is available as to the progress of the 8,000-ton plant planned by Empresa Electro-Mecanica de Córdoba.

Surinam.—Virtually all of the 1,670,000 metric tons of bauxite exported by the Surinamsche Bauxite Maatschappij (subsidiary of Republic Mining & Mfg. Co.) and the N. V. Billiton Maatschappij were sent to the United States and Canada. Owing to the drop in shipping quotas, bauxite production probably will be only about 800,000 to 900,000 tons in 1944. It is thought that production from Surinam and British Guiana will be nearly equalized to divide the economic shock of the cut-back evenly between the two countries. In 1943 the production of the Surinamsche Bauxite Maatschappij was from two mines—the Paranam mine (60 percent of total) and the Moengo mine (40 percent). The Billiton mine is located near the Paranam mine of the former company, and a loading station has been constructed about a mile downstream from Paranam at Smalkalden. All ore shipped by the Billiton company is imported by the United States Government under contract. Dredging operations on the sandbar blocking the entrance to the Surinam River have been progressing for some time to make it possible for larger boats to be loaded up the river.

Sweden.—The alumina plant of A. B. Svenska Aloxidverken at Kubikenborg near Sundsvall is now thought to be operating at its capacity of 6,000 tons a year. The alumina is produced by the Pedersen process from andalusite mined by Boliden Gruv A. B. After the war this plant can be easily converted to bauxite if desirable and then will have a capacity of 8,000 tons a year. Svenska Aloxidverken also has built and put into operation an aluminum-reduction plant at Kubikenborg with a rated capacity of about 2,100 tons of metal a year. Synthetic cryolite is now made by the company at its Brantevik fluorspar mine. Total Swedish metal capacity is now about 4,000 tons a year, including the capacity of the Månsbo works, but it is doubted that production is at present 100 percent of capacity owing to the difficulty of obtaining alumina to make more than about 3,000 tons of aluminum.

Switzerland.—In 1943 the Swiss War Economy Office lifted the restrictive measures on the use of aluminum. The metal again can be used for household articles, packing material, fittings, and other items.

U. S. S. R.—Bauxite deposits are found in the northern and central Urals; the main deposit is at Krasnaya Shapochka, north of Serov on the left bank of the Vagram River. Reserves are estimated at 9,200,000 tons averaging about 56 percent Al_2O_3, 3.5 percent SiO_2 and 27 percent Fe_2O_3. A deposit at Sokolovskoe, 20 miles east of Kamensk, contains an estimated 2,600,000 tons. Other deposits are found at Alapaievsk, and at Resh, but the bauxite is said to be of rather low quality. In the Malofasensk area a recent discovery of bauxite is estimated to have reserves of about 10,000,000 tons. The sites of the Volkhov and Dnieper plants which had a combined capacity of 69,000 tons before the war have been recaptured by the Red Army, but it is believed that the plants have been virtually demolished. It is probable, however, that reconstruction of these works is already under way. No information is available on the several large plants rumored to be operating beyond the Urals.

MERCURY

By H. M. MEYER AND A. W. MITCHELL

SUMMARY OUTLINE

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SUMMARY

From a war standpoint 1943 was a satisfactory year in respect to mercury. When the year began, efforts of the Government were directed toward increasing supplies and reducing requirements to assure the filling of war and essential civilian needs. That these efforts would be successful was evident even in the figures for 1942. The war agencies, however, could not stop short of amply covering all possible needs, which early in 1943 included large and expanding demands for chemical warfare and prospects for a repetition of the substantial orders from the U. S. S. R. Also there was question as to the extent of domestic reserves and the ability of domestic mines to continue the high output rate of the recent past. As a consequence more metal was provided than later proved necessary and in the final quarter of 1943 the industry faced near-record supplies, a sharply reduced demand, and a toppling price structure.

In the first 8 months of 1943 domestic production did not equal consumption requirements. This condition is normal for the United States, as before 1940 production had exceeded apparent consumption in only 4 out of 30 years—that is, 1910, 1916, 1917, and 1931. High prices were the principal factor in bringing about the temporary self-sufficiency of 1940–42. In September 1943 a production excess returned, in October and November output was at a rate exceeding 5,000 flasks a month, and during the last quarter of the year consumption fell to an average of 3,600 monthly. The heavy production in the final quarter of 1943 carried the total for the year to 51,929 flasks, the highest annual amount since 1882. Although consumption lagged in the last 3 months of 1943, it established a new all-time high record of 54,500 flasks for that year. Meanwhile imports were also at a new high annual rate in 1943; and the Russian requirement for metal, which led to the large exports in the 12 months ended August 31, 1943, was not repeated and showed no signs of being repeated. At the end of 1943 the accumulation of mercury in Government stock piles, here and in London, was equivalent to about a 2-year supply at the rate prevailing in 1943.

In the fall the war agencies began to retreat from their former position of encouraging production and imports and discouraging consumption. On September 9, 1943, Conservation Order M-78 was revised to permit greater use of the metal, followed by revocation of the order on February 2, 1944. In September, too, the Metals Reserve Co. canceled its contract with the Consolidated Mining & Smelting Co. of Canada, Ltd., for metal from its British Columbia mine, effective October 9. Mercury was reduced to the W. P. B. group III labor classification during the year, which made it more difficult to obtain needed manpower, for development particularly and for other work at the mines, to bolster the already insufficient supply. The labor problem alone (producers said in October) probably would reduce domestic production 25 to 30 percent within 3 months and after that would cause the closing of most of the mines of the country. At the end of December Metals Reserve Co. announced that January 31, 1944, would be the last date on which it would purchase domestic metal under contracts with "qualified" producers, electing to make the penalty payments provided for in the event of contract cancelations.

Salient statistics of the mercury industry in the United States, 1939–43

[Flasks of 76 pounds]

	1939	1940	1941	1942	1943
Production...flasks..	18,633	37,777	44,921	50,846	51,929
Number of producing mines...	107	159	197	184	146
Average price per flask:					
New York...	$103.94	$176.87	$185.02	$196.35	$195.21
London...	$88.26	$201.10	$194.20	$227.87	$281.44
Imports for consumption:					
Pounds...	265,944	12,971	588,228	2,959,489	3,633,216
Equivalent flasks...	3,499	171	7,740	38,941	47,805
Exports:					
Pounds...	91,789	730,877	196,837	[2] 26,252	[2] 29,236
Equivalent flasks...	1,208	9,617	2,590	[2] 345	[2] 384
Consumption...flasks..	[1] 20,900	26,800	44,800	49,700	54,500

[1] Apparent consumption.
[2] See discussion of "reexports" under Foreign Trade.

The Army found that it had made too great commitments for supplies of mercuric chloride, and the anticipated return of this material to consumption channels further threatened the already weakened market. The chloride had not been disposed of through the first quarter of 1944, however, because of the desire to prevent unnecessary dislocation to the industry.

The inevitable consequence of the above events was a falling price that gathered momentum as unfavorable market factors accumulated In 1943 the quoted price was $196 a flask at New York until the last week in September. It was $190–$193 at the year end, upheld in the last days chiefly by Metals Reserve contract purchases. By the end of January 1944 the quoted price stood at $130, where it held temporarily. Small lots were reported sold at less than the quoted price.

At a Mercury Producers Industry Advisory Committee meeting, January 29, 1944, producers estimated the amounts of production that would be brought out in 1944 at various price levels as follows: At $150, New York, 46,000 flasks; at $130, 33,000; and at $100, 22,000. At $80 a few mines might operate for a very brief period, but any continued output was doubtful. Estimates were based upon the then current costs of material and labor.

Supplies of mercury in Western Hemisphere sources outside of the United States gained also in 1943, and the new high record rate in Canada more than offset the drop in Mexico from the all-time record for 1942. Production in Canada was 22,487 flasks in 1943 compared with 13,630 flasks in 1942, and that in Mexico totaled 28,321 flasks compared with 32,443. Chile probably increased its output in 1943, but there is believed to have been no noteworthy gain in Peru. Production in the Western Hemisphere makes an impressive record in comparison with that in the pre-war period. In 1943 the countries named and the United States together produced about 105,000 flasks of mercury, which is more than four times the 26,000 flasks recovered by the same countries in 1939. Previous Yearbook chapters have congratulated industry and Government for turning the mercury deficiency of the Allied Powers into wartime self-sufficiency; in 1943, as has been pointed out already, the condition became one of temporary excess.

The nominal surrender of Italy to the Allies in 1943 promised greatly increased quantities of mercury for the victors in the future, but owing to occupation of the producing areas by the German army no metal from that source was immediately available.

Conservation Order M-78.—This conservation order served effectively the purposes for which it was drawn. The controlled consumption combined with increased supplies to relieve the earlier critical situation regarding mercury. Consequently, the provisions of the order were relaxed on September 9 to permit its use for the following purposes, formerly banned, and in the proportions indicated: Marine antifouling paint, 100 percent of base period; preparations for film developing, 100; thermometers (except industrial and scientific), 80; treatment of green lumber, 100; vermilion, 80; wall switches for nonindustrial use, 100; wood preservation, 100. In addition, the amounts of mercury permitted for use in mercuric fulminate for commercial blasting caps were increased to 200 percent of the base period chosen compared with 125 percent in the original order, and the allotment for industrial and scientific thermometers was revised to 200 from 100 percent. The revision to the order removed all limitations on health and agricultural uses. The growing excess of supplies over requirements led to revocation of the conservation order on February 2, 1944.

Metals Reserve Co. domestic purchases.—The provisions of the Metals Reserve Co. for purchasing domestic mercury were outlined briefly in Minerals Yearbook, 1942. When the purchase plan was extended to December 31, 1944, it was specified that "qualified producers" (those who produced not more than 90 flasks of mercury in April 1942) must "contract in writing with Metals Reserve Co. to aid in supplying the increased requirements for war by producing at maximum capacity until December 31, 1944." Metals Reserve was to purchase all or any part of the production of such producers, provided the total for any one did not exceed 300 flasks in 1944, except by special arrangement. Their production, however, could go partly or entirely to others than Metals Reserve. Provision was made for terminating the program within 30 days of notice of the intention to do so on or after December 31, 1943. The greatly improved supply situation led the Metals Reserve Co. to serve notice on December 8 that December 31 was the last date upon which producers could apply for confirmation as "qualified" producers, and the buying program was halted January 31, 1944. The company selected the termination penalty to "Settle in cash for such producer's 'total unfilled production' of mercury on the basis of $20 per flask." Such total unfilled production was the amount of mercury equivalent to the producer's average monthly production for the 6 calendar months preceding the effective date of the termination, multiplied by the number of months from the effective date of termination to December 31, 1944, or, as it eventuated, the average production for August 1943 to January 1944, inclusive, multiplied by 11.

Geological Survey and Bureau of Mines activities.—The Geological Survey maintains close relations with the war agencies and by the end of 1943 had transmitted to them preliminary reports on nearly all mines and districts in the country. The Survey published a report on the Ochoco district, Oregon.[1] It also announced, by press releases, the availability of maps and brief text descriptions of Arkansas quicksilver mines and prospects; the Humphreys and Caddo mines, Ark.; the Helen, Sulphur Bank, and Reed mines, Calif.; and the Chisos, Rainbow, and Viviana mines, Texas. A manuscript report on the Horse Heaven district, Oregon, was placed in open file in Portland, Spokane, and Washington, where it is available for consultation by interested persons. This report is of interest not only because it describes an important mercury district but because it points out a close genetic relationship between mercury deposits and certain kinds of intrusive igneous rock bodies.

The Survey completed field work in Nevada and began to prepare a comprehensive State report. Field work was also completed in the Ochoco, Maury Mountains, Steens and Pueblo Mountains, Brownsboro, Tiller, Trail, and Clackamas districts of Oregon and in the Sulphur Bank, Altoona, and Wilbur Springs districts of California. Detailed examination of mines in the Terlingua district, Texas, begun the previous year, was completed, but aerial mapping was continued into 1944. At the end of the year, geologic field work was still in progress in the Los Prietos and Cachuma districts, California, and many mines in other parts of the State were being periodically reexamined to maintain current information. With the Bureau of Mines, a cooperative exploration program at the Oat Hill mine was opened and continued past the year end. The intensive study of the New Almaden district, begun in 1941, was continued throughout the year. In addition to its geologic studies there, the Survey cooperated closely with the Bureau of Mines in a drilling campaign to test the more promising structures in the New Almaden mine.

The Geological Survey examination of Alaskan mercury deposits, begun in 1941, was continued and expanded in 1943. Sampling exposures by the Bureau of Mines in the Decoursey Mountain area were studied by Survey geologists, and other mapping was done that resulted in discovery of three intrusive stocks but no new mercury deposits. The Cinnabar Creek area in the Holitna and Aniak River drainage basins was studied, and the deposits were found to be of the same type and presumably of similar size and grade as those at

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[1] Stephenson, E. L., Geophysical Surveys in the Ochoco Quicksilver District, Oregon, a preliminary Report: Geol. Survey Bull. 940-C, 1943, pp. 57-98.

Decoursey Mountain and Sleitmut. A Survey party made reconnaissance studies in the Kuskokwim region in a search for altered intrusive stocks and related sills near which deposits of the Sleitmut type might be expected. The Sleitmut deposits, which had previously been mapped in detail, were reexamined to appraise the geologic results of development by the Bureau of Mines and by the operating company.

During 1943 two Survey geologists were investigating mercury deposits in Mexico in cooperation with the Department of State. One of them examined the deposits at Huitzuco, Guerrero, where the ore contains mercury and antimony in the unusual mineral livingstonite. A report on this district will be published soon as a chapter of the bulletin, Geological Investigations in the American Republics. The other geologist continued his program of mapping the Sain Alto and several other important Mexican mercury districts. To date all his reports have been memoranda to the war agencies.

As previously indicated, in part, the Bureau of Mines in cooperation with the Geological Survey continued its search for mercury in 1943 and explored deposits in Alaska, California, Nevada, Oregon, and Texas by means of mining work, diamond drilling, trenching, and stripping.

Exploration in Alaska continued in the Sleitmut district and at the Decoursey mine, in the former area principally by underground operations and in the Decoursey mine by trenching and stripping. The Bureau also aided in the construction of a landing field at Decoursey, as airplane service is essential owing to the isolated situation of this property.

Explorations were conducted in California on the Guadalupe and New Almaden properties in Santa Clara County and on the Oat Hill mine in Napa County.

The Bureau completed drilling and dump sampling begun last year at the Guadalupe mine. Drilling at the New Almaden was begun in August and at the Oat Hill in November. Both these projects are continuing into 1944 with the object of discovering extensions of previously mined ore bodies.

Work in progress last year on the Bretz-Cordero properties in Oregon and Nevada was also completed.

Diamond drilling was carried on in the Terlingua district, Texas. Although this exploration disclosed no ore, valuable geological data were obtained essential for the guidance of future operations in this extensively mineralized area.

During 1942 and 1943, exploration by the Bureau of Mines developed about 600,000 tons of ore containing the equivalent of 37,000 flasks of mercury.

War minerals reports were released for limited distribution on the following properties in 1943:

Red Devil mine, Sleitmut area, Southeast Alaska; Coso Mercury deposit (Inyo County), Falcon mine (Santa Barbara County), New Almaden mine (Santa Clara County), Guadalupe mine—Supplement (Santa Clara County), California; Bonanza (Hermes) mine (Valley County), Idaho; Rand mine (Elko County), Bretz mine (Malheur County), Oregon; and Cordero mine (Humboldt County), Last Chance (White Peaks) mine (Humboldt County), Nevada; Nonpareil Mercury mine (Douglas County), Black Butte mine (Lane County), Pacific Syndicate mine (Jackson County), War Eagle mine (Jackson County), Bretz Mercury mine dumps (Malheur County) (supplement to report listed under Nevada), Oregon.

Data were also available in the form of memoranda on numerous other properties and areas.

POST-WAR OUTLOOK

In recent years and during the war period there has been a trend away from the use of mercury for certain purposes. There is little reason to expect that the felt industry will return to it after the war. Substitutes for mercury fulminate appear to have gained ground, and a drop in this application may be anticipated in favor of lead azide and other substances. Plastic and copper oxide paints replace mercury oxide for antifouling and may gain in this field. Certain pharmaceutical uses may also bow out to substitutes. On the whole, however, the place of mercury in the industrial future is believed to be assured, at least at former levels. Gains in use in the manufacture of lamps, arc rectifiers, and other electrical apparatus, in instruments and control devices, and perhaps for agricultural purposes are expected to offset the possible decreases indicated. Relative cost, efficiency, and industrial habit will prevent large-scale substitution until mercury is much scarcer than at present. The throwing back on the market of surplus Government materials, however, would temporarily reduce requirements for new metal.

A probable return to pre-war prices or to near that level would cause a sharp decline in the portion of the market supplied by domestic mines.

PRICES

The quoted price for mercury held at $196 at New York, per flask of 76 pounds, from the last week in October 1942 to the last week in September 1943. It then dropped $1, followed by further declines of $3 and $2, respectively, late in November and early in December. The market weakened considerably in January 1944 in anticipation of the discontinuance of Metals Reserve buying at the end of that month. By the last week in January the quotation was down to $130 a flask with nothing in evidence that would cause a noteworthy reversal in the price trend. Throughout the year the ceiling price limitations established by the Office of Price Administration in February 1942 were in effect. Ceiling price provisions were outlined in the Mercury chapters for 1942 and 1941.

As in 1942, there was no evidence of any changes in the price for Spanish and Italian metal. This price was established at $250 a flask, f. o. b. ports of origin, in December 1940. There is nothing normal, however, about the transactions in what would ordinarily be the international market. Germany has been the principal market for Italian and Spanish mercury since the outbreak of war in Europe, and German methods of purchase leave the effectiveness of the $250 price open to question. Purchases by other countries would seem also more apt to be upon the basis of negotiation rather than of a restricted price.

Average monthly prices per flask (76 pounds) of mercury at New York and London, and excess of London price over New York price, 1941–43

Month	1941			1942			1943		
	New York [1]	London [2]	Excess of London over New York	New York [1]	London [2]	Excess of London over New York	New York [1]	London [2]	Excess of London over New York
January	$165.85	$193.64	$27.79	$202.52	$194.69	[3] $7.83	$196.00	$281.44	$85.44
February	170.18	193.43	23.25	197.27	194.69	[3] 2.58	196.00	281.44	85.44
March	177.69	193.53	15.84	197.05	194.68	[3] 2.37	196.00	281.44	85.44
April	180.08	193.19	13.11	197.10	194.69	[3] 2.41	196.00	281.44	85.44
May	180.00	194.50	14.50	197.30	194.69	[3] 2.61	196.00	281.44	85.44
June	183.92	194.52	10.60	194.28	194.69	.41	196.00	281.44	85.44
July	188.58	194.56	5.98	194.43	194.69	.26	196.00	281.44	85.44
August	192.00	194.53	2.53	194.43	257.56	63.13	196.00	281.44	85.44
September	192.44	194.58	2.14	194.43	278.52	84.09	195.72	281.44	85.72
October	193.62	194.59	.97	195.35	278.52	83.17	195.00	281.44	86.44
November	196.27	194.65	[3] 1.62	196.00	278.52	82.52	193.70	281.44	87.74
December	199.65	194.69	[3] 4.96	196.00	278.52	82.52	190.08	281.44	91.36
Average	185.02	194.20	9.18	196.35	227.87	31.52	195.21	281.44	86.23

[1] Engineering and Mining Journal, New York.

[2] Mining Journal (London) prices in terms of pounds sterling are converted to American money by using average rates of exchange recorded by Federal Reserve Board. Official prices, established early in May 1941, were £47 15s. to £48 15s. per flask until August 1942, when they were raised to £68 10s. to £69 15s.

[3] New York excess.

Control maximum prices in London remained unchanged from those during the late months of 1942, at £69 15s. a bottle for over 1 bottle and less than 11 bottles and £69 for larger amounts, ex-sellers' premises in both cases. These prices, however, were approximately £20 higher than those prevailing before August 1942. Higher prices prevailed for lots under 1 bottle and for redistilled grades.

CONSUMPTION AND USES

Mercury has a wide diversification of end uses; actually over 3,000 are known. Its high specific gravity, its fluidity at ordinary temperatures, its electrical conductivity, and the properties of its vapors lead to its use in instruments, control devices, lamps, and other apparatus. The poisonous quality of the metal and its compounds is responsible for their broad use in inhibiting bacterial and parasitic growths. The principal war as well as peacetime use is in the manufacture of pharmaceuticals, and the sharp gains in consumption for this purpose in 1943 stems from the Army's large requirements for prophylactics and antiseptics. Mercury acts as a catalyst in numerous chemical reactions. For a large part of 1943 the principal quantities were consumed as a catalyst in the manufacture of chemicals for chemical warfare use. This use is included under "other" in the accompanying table. The Maritime Commission construction program gave impetus to consumption of mercury in antifouling paint for ship bottoms, which considerably more than doubled in 1943. The Navy reportedly had discontinued the use of mercury paint in favor of plastic paints and cuprous oxide paint before 1943 but used at least some of the mercury product in 1943. Consumption of mercury in calomel for tracers (munitions other than fulminate) in 1943 was cut to little more than one-third of the total for 1942. The use of mercury in fulminate declined about one-fourth in 1943.

Supply of mercury in the United States, 1939–43, in flasks of 76 pounds

Year	Production	Imports for consumption	Exports	Consumption
1939	18,633	3,499	1,208	[1] 20,900
1940	37,777	171	9,617	26,800
1941	44,921	7,740	2,590	44,800
1942	50,846	38,941	[2] 345	49,700
1943	51,929	47,805	[2] 384	54,500

[1] Apparent consumption.

[2] See discussion of "reexports" under Foreign Trade.

Mercury consumed in the United States in 1942 and 1943, in flasks of 76 pounds

Use	1942 [1]	1943 [1]	Use	1942 [1]	1943 [1]
Pharmaceuticals	8,088	14,563	Electrical apparatus	4,550	3,284
Dental preparations	1,198	556	Industrial and control instruments	[2] 3,529	[2] 3,674
Fulminate:					
Munitions	4,146	1,931	Amalgamation	180	24
Blasting caps		1,211	General laboratory use	294	360
Munitions other than fulminate	3,684	1,286	Vermilion	215	185
Agriculture	1,533	1,632	Felt manufacture	20	-------
Antifouling paint	1,220	2,702	Redistilled	[2] 6,175	[2] 5,384
As a catalyst or in the electrolytic preparation of—			Other	[3] 9,103	[3] 11,241
Chlorine	549	691		[1] 49,700	[1] 54,500
Caustic soda					
Acetic acid	1,410	1,995			
Other	1,843	2,437			

[1] The items are on a partial-coverage basis and do not add to the total, which has been increased to cover approximate total consumption.

[2] About half of the quantity shown under "Redistilled" was for use in industrial and control instruments.

[3] Of the quantities shown under "Other," 1,028 flasks in 1942 were for a new chlorine-plant installation and to replace mercury-boiler leakages; 75 flasks in 1943 were to replace boiler leakages. It is deemed inadvisable at this time (May 1944) to divulge details covering other items.

In consequence of revocation of Conservation Order M–78, gains in the consumption of mercury may be expected for the following uses: Industrial and control instruments, electrical apparatus, agriculture, turf fungicides, and wood preservatives.

STOCKS

Consumers and dealers held 13,200 flasks of mercury at the end of 1943 compared with 10,700 flasks at the end of 1942. Meanwhile companies that report mine production monthly to the Bureau of Mines—about 95 percent of the total—had 3,457 flasks on hand compared with 1,377 flasks in 1942. Inventories in Government hands made even more noteworthy gains in 1943, advancing from 27,410 flasks at the beginning of the year to 69,852 at its end. Companies that use redistilled metal only reduced their holdings of metal in 1943 from 1,600 (revised) flasks on January 1 to 1,400 on December 31.

REVIEW BY STATES

In 1943 the accumulated stimuli to domestic mercury production provided by historic peak prices, Government buying, and other aids led to a production record (the highest since 1882) of 51,929 flasks. Producers complained throughout the year of labor shortages and, as in 1942, of the inefficiency of replacement material. The output is remarkable because it was made despite labor and other handicaps. The opening of the New Idria-Alaska (Red Devil) mine, Alaska, on a larger scale in 1943, the attainment of peak annual production at the New Idria, Calif., after more than 80 years' operation, the almost quadrupling of output at the Abbott mine, Calif., the substantial gain at Mount Jackson, Calif., and the almost doubling of large-scale production at the newly opened Hermes mine, Idaho, were the principal factors that erased the losses at many other mines and boosted the United States total.

Mercury produced in the United States, 1940–43, by States

Year and State	Producing mines	Flasks of 76 pounds	Value [1]
1940:			
Alaska	1	162	$28, 653
Arizona	6	740	130, 884
Arkansas	10	1, 159	204, 992
California	70	18, 629	3, 294, 911
Nevada	42	5, 924	1, 047, 778
Oregon	23	9, 043	1, 599, 436
Utah	1	53	9, 374
Idaho, Texas, and Washington	6	2, 067	365, 590
	159	37, 777	6, 681, 618
1941:			
Arizona	5	873	161, 522
Arkansas	19	2, 012	372, 260
California	87	25, 714	4, 757, 604
Nevada	54	4, 238	784, 115
Oregon	21	9, 032	1, 671, 101
Utah	1	19	3, 515
Alaska, Idaho, Texas, and Washington	10	3, 033	561, 166
	197	44, 921	8, 311, 283
1942:			
Arizona	7	701	$137, 641
Arkansas	16	2, 392	469, 669
California	85	29, 906	5, 872, 043
Nevada	40	5, 201	1, 021, 217
Oregon	23	6, 935	1, 361, 687
Alaska, Idaho, Texas, Utah, and Washington	13	5, 711	1, 121, 355
	184	50, 846	9, 983, 612
1943:			
Alaska	3	786	153, 435
Arizona	3	541	105, 609
Arkansas	18	1, 532	299, 062
California	65	33, 812	6, 600, 440
Idaho	1	4, 261	831, 790
Nevada	33	4, 577	893, 476
Oregon	16	4, 651	907, 922
Texas	7	1, 769	345, 326
	146	51, 929	10, 137, 060

[1] Value calculated at average price at New York.

The principal producing mines in 1943 were as follows:

Alaska—Red Devil mine.

Arizona—Gila County, Ord mine.

Arkansas—Clark County, Humphreys mine; Pike County, United States Mercury Company mine.

California—Contra Costa County, Mount Diablo mine; Lake County, Sulphur Bank, Abbott, and Mirabel mines; Napa County, Knoxville and Oat Hill mines; San Benito County, New Idria mine; San Luis Obispo County, Klau and Buena Vista (Mahoney) mines; Santa Barbara County, Falcon (Santa Ynez) mine; Santa Clara County, Guadalupe and New Almaden mines; Sonomo County, Socrates and Mount Jackson mines; Yolo County, Reed mine.

Idaho—Valley County, Hermes mine.

Nevada—Elko County, Silver Cloud mine; Humboldt County, Cordero mine: Pershing County, Red Bird and Pershing mines.

Oregon—Douglas County, Bonanza mine; Jefferson County, Horse Heaven mine.

Texas—Brewster County, Big Bend and Texas Almaden mines; Presidio County, Fresno mine.

These 28 mines produced 90 percent of the United States total; it took 34 mines to produce 89 percent in 1942 and 33 to produce 85 percent in 1941. During 1939, when low prices prevailed, 16 mines produced 88 percent of the total. Of the larger mines listed in 1942 the Idaho Almaden, Idaho, was idle throughout 1943, and the Red Rock and Great Eastern, California, were closed in the latter part of

1943. Of the foregoing list for 1943, the U. S. Mercury mine was shut in November. Many other mines closed following termination of Metals Reserve Co. buying at the end of January 1944.

The average grade of ore treated rose in 1943, against the historic trend. In 1943 the grade was 0.31 percent (6.28-pound ore), compared with 0.25 percent (5-pound ore) in 1942, 0.26 (5.2-pound ore) in 1941, 0.31 (6.2-pound ore) in 1940, and 0.37 (7.4-pound ore), in 1939.

Alaska.—Output of mercury in Alaska in 1943 came again from the Sleitmut and Decoursey Mountain areas. A Gould rotary furnace of approximately 25 tons daily capacity was installed at the Red Devil mine of the New Idria-Alaska Quicksilver Mining Co. at Sleitmut in 1943. This plant was transferred from the Red Elephant mine, Lake County, Calif., where it was built new in 1941. The New Idria Alaska operation was described[2] in 1943. Production at the Decoursey mine continued to be made in a retort. The ore from this mine is high grade and produced 212 flasks from the treatment of 60 tons.

Arizona.—Output of mercury in Arizona declined again in 1943 following a drop in 1942. Only three properties contributed to the total in 1943, however, compared with seven in 1942. The Ord mine in Gila County recovered 316 flasks from treating 4,760 tons of ore. The Pine Mountain mine in the Sunflower district, Maricopa County, made 76 flasks from 2,427 tons of ore in the first part of the year and 137 flasks from 1,863 tons in the latter part, under two managements. Furnaces were used at both properties.

Arkansas.—Arkansas produced 36 percent less mercury in 1943 than in the record year 1942—1,532 flasks compared with 2,392. There were two more producing mines in 1943, but by the end of the year the larger ones were either closed or facing almost immediate shutdowns. Very few smaller mines were operating as 1943 closed. The largest producer was the Humphreys Gold Corporation, operating in Clark County. It furnaced 13,451 tons of ore during the year to recover 691 flasks. Development was discontinued in 1943, and the plant was shut on February 20, 1944. The Caddo mine, also in Clark County, closed on October 2, 1943. All other productive properties in Arkansas were in Pike County; the chief was the U. S. Mercury Co. This company went out of business in November after producing 337 flasks in 1943 from 4,260 tons of ore furnaced. The Arkansas Quicksilver Mines, Inc., operating the Parker Hill and Parnell mines during 1943, was the next most important producer in the State. Other producing mines were the National, Muddy Fork, and Inter-State Trust (Superior), all of which used furnaces. Virtually all of the other production in the district was from small retorting operations.

California.—California again increased its predominant position in mercury production during 1943. The gain from 29,906 flasks (approximating 59 percent of the United States total) to 33,812 flasks (65 percent) was due largely to the outstanding performance of the largest producing mine in the country, the New Idria. Its output gained almost 75 percent during the year and almost equaled that of the five next most important mines in the country. Several other California mines made noteworthy gains, however, including the Abbott, Mount Jackson, and Buena Vista (Mahoney). On the other hand, production decreased considerably for such important producers as the Sulphur Bank, Reed, Klau, and Great Eastern. Seventeen counties contributed some production in 1943, as follows: Colusa, Contra Costa, Del Norte, Fresno, Inyo, Kings, Lake, Monterey, Napa, San Benito, San Luis Obispo, Santa Barbara, Santa Clara, Siskiyou, Sonoma, Trinity, and Yolo.

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[2] Mining World, New Idria-Alaska Quicksilver Mining Co.: Vol. 5, No 10, October 1943, p. 18.

The Wide Awake mine in Colusa County was operated during the first 6 months of the year; and, as usual, the only active mine in Contra Costa County was the Mount Diablo. The only mercury operation in Del Norte County was the Patrick Creek prospect, which made a small output.

In Fresno County small amounts of mercury were recovered at three localities.

Two operators produced mercury at the old Coso mine, Inyo County, in 1943. The Atlas mine, in the same district, began production in December.

A small production was reported for the Kings mine, Kings County.

Lake County ranked as the third largest producing county in the United States in 1943, with an output of 4,197 flasks. Output came as usual from the old leaders—the Sulphur Bank, Mirabel and Great Western. The Abbott mine, which became a noteworthy producer again in 1942, ranked as the ninth largest producing mine in the United States in 1943. The company sank the main shaft an additional 100 feet and opened the 400-foot level. Operations at the Mirabel [3] mine were described in 1943. The Midway mine made a very small contribution to the county total.

Twelve properties in Napa County, chief among which were the Oat Hill, Knoxville, Aetna, and the Oat Hill Extension, produced some mercury in 1943. This was the fifth largest mercury-producing county in California in 1943; the total output was 1,940 flasks.

The outstanding record of the New Idria mine in 1943 made San Benito County the leading mercury-producing county in the United States, with an output of 14,187 flasks. Although the New Idria has produced mercury for many years and has a recorded production beginning in 1858, its peak for a single year was attained in 1943. It was easily the largest producing mine in the United States and is believed to have been surpassed in the Western Hemisphere only by the Consolidated property, Canada. The Lea-Grant ranked second in importance in the county and had 3 operators during the year. The Stayton mine and 6 others also added to the county total in 1943. Production ceased at the Panoche (Valley View) mine in March, and later in the year the 4-64-foot rotary furnace was moved to the Guadalupe mine in Santa Clara County.

The output of 2,618 flasks of mercury in San Luis Obispo County in 1943 (compared with 2,760 in 1942) was drawn from 6 properties, by far the largest of which was the Klau mine. Development was done on the 450-foot level, the deepest at this mine, and a diamond-drilling program was in progress early in 1944. Important quantities were reported for the Buena Vista (Mahoney), the Oceanic, and the Polar Star. Production came also from the Buckeye and the Rinconada mines. The 50-ton Gould rotary furnace was moved from the Idaho-Almaden to the Polar Star mine in 1943 and began operations late in September. Production in 1943 was from open pits, but development underground was under way at the end of the year.

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[3] Mining World, Mirabel Quicksilver Mine: Vol. 5, No. 11, November 1943, pp. 18-19.

The Falcon (Santa Ynez) mine was the largest producer in Santa Barbara County in 1943. The Red Rock also made a substantial contribution but closed in September. One other producer in the county was active. Total output for the county dropped from 1,582 flasks in 1942 to 1,229 in 1943.

Santa Clara County produced 1,729 flasks of mercury in 1943 compared with 2,283 in 1942. The outstanding producer in 1943 was again the New Almaden mine. The Almaden dumps and the Guadalupe mine were next in importance, and 4 others contributed smaller amounts. The New Almaden property was recently described.[4] As previously stated, the furnace at the Panoche mine, San Benito County, was moved to the Guadalupe mine, where it had only a few days' run in 1943.

The Empire Canyon (Great Northern) mine was the only one in Siskiyou County that reported production in 1943. This mine changed hands during the year.

Sonoma County produced 4,111 flasks of mercury in 1943, almost identical with the 4,114 flasks reported for 1942. The Mount Jackson had again by far the outstanding amount, followed by the Socrates, Great Eastern, and Culver-Baer. Five other properties contributed to the total. Underground operations on the 500-foot level at the Socrates mine were discontinued, and surface operations were to be given a trial. The Great Eastern mine produced 161 flasks from 4,351 tons of ore in 1943. It did not produce after September and was abandoned by Magee Mercury, Inc., at the end of the year. The Culver-Baer mine produced 146 flasks from 1,389 tons of ore. The Cloverdale mine closed in November, and the Skaggs Springs mine closed in September after producing 30 flasks from 460 tons of ore.

The Altoona mine in Trinity County began to produce in July, and in December its output placed it among the highest 10 producers in the country at that time. From July to December a total of 1,939 tons of ore was treated to recover 280 flasks of metal.

The Reed mine, the fifth largest mercury-producing property in the United States in 1943, made the largest contribution of any Bradley Mining Co. mine in that year. The Harrison mine was the only other mercury producer in Yolo County in 1943.

Idaho.—The Hermes was the only mercury-producing mine in Idaho in 1943, but its output of 4,261 flasks (from the treatment of 71,941 tons of ore) made Valley County the second largest mercury-producing county in the United States. The Hermes mine had the second largest mercury output in 1943. The mining system at this property has been changed from square setting to top slicing, which the company claims has resulted in some saving of manpower and the recovery of more and cleaner ore from the stopes. The property was described in 1943 by Bradley.[5]

Nevada.—Output declined 12 percent in 1943 and the number of producing mines from 40 to 33. The chief mine in both years was the Cordero, Humboldt County, which ranked eighth in the country.

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[4] Engineering and Mineral Journal, New Almaden Today: Vol. 144, No. 3, March 1943, pp. 59–61.

[5] Bradley, Worthen, The Hermes Quicksilver Mines, part I: Min. Cong. Jour., vol. 29, No. 11, November 1943, pp. 32–34 and part II, vol. 29, No. 12, December 1943, pp. 40–44.

Cordero's output dropped 22 percent in 1943, however. This decline and the shutting of the White Peak mine, which produced 343 flasks in 1942, were the principal factors in Nevada's lowered production rate. The Silver Cloud mine, Elko County, and the Red Bird mine, Pershing County, on the other hand, made large production gains in 1943. The Pershing mine, second in importance in the State, maintained its output at virtually the 1942 rate. The following counties were productive in some measure in 1943: Churchill, Elko, Esmeralda, Humboldt, Mineral, Nye, and Pershing.

Four properties in Elko County produced 842 flasks of mercury in 1943—the Silver Cloud, Butte (Bowers and Rand), Velvet, and Silver Fox. The Silver Cloud mine changed hands during the year.

There were three small mercury operations in Esmeralda County during 1943.

The Cordero mine dominated production in Humboldt County, and five others made small contributions to the total. This county slightly outranked Pershing County as the most important one in Nevada in 1943.

There were two small mercury producers in Mineral County and five of somewhat greater average importance in Nye County. J. H. Smith was the largest producer, operating two properties—the A and B and the M and M.

Except for Pike County, Ark., more mines were producing mercury in Pershing County in 1943 than in any other county in the United States—11 in all. A total of 1,749 flasks was produced compared with 1,525 flasks in 1942. In both years the Pershing mine was the outstanding producer, with 890 flasks from 19,866 tons in 1943 compared with 855 flasks from 18,041 tons in 1942. The Red Bird was second in both years, with production in 1943 much above that in 1942.

Oregon.—With an output of 4,651 flasks in 1943, Oregon maintained its place as the second largest mercury-producing State by a narrow margin; Nevada produced 4,577 flasks. Oregon's total represented a drop of 33 percent from 1942, which in turn was 23 percent below 1941.

One property in Clackamas County and five in Crook County had small mercury outputs in 1943.

The Bonanza mine in Douglas County was the third largest producer in the United States; it held first place in Oregon, with an output of 3,294 flasks from the treatment of 29,509 tons of ore. There are now two plants at this mine, a Gould rotary and a Herreshoff. Development in 1943 consisted of the extension of the shaft and drifts on the 700-foot level. The Buena Vista mine was equipped and treated 300 tons of ore in a Gould rotary furnace in 1943, recovering a small amount of metal.

The Mountain King and two other properties produced mercury in Jackson County. A furnace with a reported capacity of 25 tons was installed at the Mountain King mine in 1942.

The Horse Heaven mine in Jefferson County was the second largest producer in the State. The Axe Handle mine in this county also produced.

Production from dumps and from furnace clean-up operations at the Black Butte mine, Lane County, resulted in the output of 38 flasks of metal.

Both the Opalite and Bretz mines in Malheur County produced in 1943, but their total was considerably under their 1942 rate.

Texas.—Production of mercury in Texas totaled 1,769 flasks, a noteworthy decline from 1942. As in 1942, the principal part of the production came from the Texas Almaden and Big Bend mines of the Texas Mercury Co., Brewster County, and from the Fresno mine, Presidio County. The Esperado Mining Co. began production at the Chisos and Waldron properties, Brewster County, in October but required adjustments to newly installed plants impeded capacity operations. Three other properties in Brewster County made some production during the year.

FOREIGN TRADE [6]

Imports of mercury for consumption in 1943 were 47,805 flasks or 23 percent larger than in 1942; as a consequence, they established a new all-time high record. As in 1942, a substantial part of the metal received was reexported in the same form. This situation is discussed in more detail later. Of the total imports, Mexico supplied 29,457 flasks or almost double the 15,581 flasks from Canada; Chile furnished 2,660 and Peru 107 flasks. Receipts from Mexico were slightly less than in 1942, whereas those from Canada more than doubled and those from Chile almost doubled the 1942 rate. Considerably more mercury would have been received from Canada had not the Metals Reserve Co. contract with the Consolidated Mining & Smelting Co. of Canada, Ltd., been canceled in September 1943. Receipts of metal from Peru were considerably under the original expectations. The Western Hemisphere supplied all of the mercury imported for consumption in the United States in both 1943 and 1942. There was wide fluctuation in the monthly figures on imports, but no trend was evident. More was received in June than in any other month—7,151 flasks—and this large quantity was due partly to the inclusion in it of mercury confiscated by the Mexican Government in 1941. Only 2,437 flasks were received in January, and less than 3,000 flasks each in February, April, and November. Only the low November total of 2,572 flasks is significant, it is believed, because the level of importation was affected by lack of receipts from Canada.

General imports, which may differ considerably from imports for consumption, corresponded almost precisely with them in 1942 and 1943 and were relatively close in 1941. General imports totaled 47,836 flasks in 1943, 38,951 in 1942, and 7,478 in 1941. When there are noteworthy differences between the two classes, general imports furnish a better guide to the amounts of metal actually entering the country.

The movement of antimony-mercury concentrates to this country, which yielded an average of over 1,200 flasks annually for 1940–42, inclusive, was halted in December 1942. This class of imports is not shown separately in foreign-trade statistics.

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[6] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Mercury imported for consumption in the United States, 1939–43, by countries

Country	1939		1940		1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Canada					59,633	$130,468	562,348	$1,337,640	1,184,211	$3,009,271
Chile							107,091	266,920	202,148	506,710
Hong Kong			3	$6						
Italy	25,528	$29,818	228	316						
Mexico	42,745	61,313	9,698	13,681	520,692	1,171,752	2,288,505	5,122,516	2,238,725	5,010,038
Nicaragua							1,545	3,895		
Peru									8,132	19,934
Spain	197,671	245,613	3,042	3,958	7,903	6,373				
	265,944	336,744	12,971	17,961	588,228	1,308,593	2,959,489	6,730,471	3,633,216	8,545,953

Imports of mercury compounds again had no significance, as is shown by the table that follows.

Mercury compounds imported for consumption in the United States, 1942–43

Compound	1942		1943	
	Pounds	Value	Pounds	Value
Chloride (mercurous) (calomel)	1	$4		
Mercury preparations (not specifically provided for)	1	6		
Vermilion reds (containing quicksilver)	25	10	15	$6
		20		6

Exports of mercury from the last quarter of 1942 through the first 4 months of 1943, as well as in June and August 1943, were dominated by shipments to the U. S. S. R., which were parts of two commitments entered into in 1942. The quantities so shipped were originally classed by the United States Department of Commerce as "exports," but they have been redesignated since chiefly as "reexports" owing to the fact that they consisted mainly of imported metal that was reshipped without changing its form. Some of the original 1943 figures were revised as well as redesignated. The final results show 384 flasks as exports (domestic metal) and 14,852 flasks as reexports (foreign metal). Corresponding figures for 1942 are 345 and 7,461 flasks, respectively. All of the reexported material went to the U. S. S. R. The much smaller exports, on the other hand, went to several dozen countries in both years. The leading destinations in 1943 were as follows: South America took 128 flasks; Asia (except U. S. S. R.) 79; U. S. S. R., 66; North and Central America, 61; Africa, 30; and Oceania, 20. Brazil received the largest amount for any country, with 89 flasks, followed by the U. S. S. R., as already indicated, with 66 flasks.

Commerce records of shipments to the U. S. S. R. in 1942 and 1943 are less than amounts released by Metals Reserve Co. from Government stock piles for shipment to that country (23,578 flasks) and lend-lease reports of shipments (23,485 flasks). It has been impossible to obtain an exact check, and Commerce data are believed to be low by possibly 1,000 flasks.

If Commerce figures require upward revision, exports as well as reexports could be affected.

Mercury exported from the United States, 1939–43

Year	Pounds	Value	Year	Pounds	Value
1939	91, 789	$137, 427	1942	26, 252	$76, 448
1940	730, 877	1, 743, 149	1943	29, 236	88, 842
1941	196, 837	470, 903			

Mercury salts exported for 1942 and 1943 are shown in the following table. A noteworthy gain is indicated in shipments of mercuric oxide.

Mercury salts exported from the United States, 1942–43, in pounds

	1942	1943		1942	1943
Mercurous chloride (calomel)	22, 844	16, 950	Mercuric oxide (red and yellow)	9, 495	50, 483
Mercuric chloride (corrosive sublimate)	7, 261	12, 422	Mercuric sulfate	15	36
Mercuric fulminate	39, 595	35, 450	Mercuric sulfide	6	25
Mercuric nitrate	477	570	Other compounds	8, 518	7, 388

WORLD PRODUCTION

Although authentic information is not available covering production of mercury in Spain and Italy, the two leading world sources for many recent years, enough data are at hand to indicate that new high records were established for the world as a whole in 1941 and again in 1942, and that the output in 1943 probably was second to production in 1942 and possibly also to that in 1941. The lower rates estimated for Spain and Italy in 1943 are predicated on the large stocks reported to be available in Spain in 1942 and on the belief that Germany was well-stocked with mercury before Allied troops arrived in Italy in 1943 and a battle area was established not far south of the principal Italian mines. As has been pointed out previously in the reports of this series, the increases are due mainly to gains in output in Western Hemisphere sources that have made the Allied Powers independent in regard to essential mercury supplies.

Canada.—Production in Canada exceeded all previous records again in 1943, following new high rates attained in each successive year since the Consolidated Mining & Smelting Co. of Canada, Ltd., began to produce in the Pinchi Lake area of British Columbia in 1940. In 1943 production totaled 22,487 flasks compared with 13,630 in 1942. Following the easing of the mercury-supply situation in the United States, the contract between Consolidated and the Metals Reserve Co. was terminated in September, effective October 9. The Northern Miner of March 23, 1944, points out that the Consolidated mine had developed into the largest mercury mine in North America. In point of production, at least, its total exceeded that of any other producer in the Western Hemisphere in 1943. The annual report of the company indicated that the critical labor shortage restricted development during the year, but stated that several rich stopes were opened and that diamond drilling gave excellent results. It said that the company hoped that the Pinchi Lake property would continue to be

World production of mercury, 1938–43, by countries, in flasks

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Algeria	191	(1)	(1)	(1)	(1)	(1)
Australia: Queensland	--------	3	(1)	(1)	(1)	(1)
Bolivia (exports)	--------	9	(1)	(1)	(1)	51
Canada	10	6	2,024	7,057	13,630	22,487
Chile	44	(1)	(1)	1,305	2,256	(1)
China	560	4,931	3,403	6,527	[2] 3,500	(1)
Chosen	(3)	(3)	(1)	(1)	(1)	(1)
Czechoslovakia	2,900	[4] 2,669	[4] 2,582	(1)	(1)	(1)
Germany [3]	1,750	(1)	(1)	(1)	(1)	(1)
Austria	(3)	(3)	(1)	(1)	(1)	(1)
Italy	66,748	67,154	(1)	(1)	(1)	(1)
Japan	592	(1)	(1)	660	(1)	(1)
Mexico	8,519	7,376	11,653	23,137	32,443	28,321
New Zealand	10	--------	--------	73	150	(1)
Peru	--------	--------	--------	--------	145	[5] 326
Rumania	--------	(1)	(1)	(1)	(1)	(1)
Southern Rhodesia	--------	(6)	(1)	(1)	(1)	(1)
Spain	41,409	35,912	52,214	86,473	(1)	(1)
Tunisia	270	(1)	(1)	(1)	(1)	(1)
Turkey	597	359	[8] 261	237	[7] 222	(1)
Union of South Africa	--------	--------	(1)	204	579	[8] 836
U. S. S. R.	[9] 8,700	(1)	(1)	(1)	(1)	(1)
United States	17,991	18,633	37,777	44,921	50,846	51,929
Total [2]	149,900	150,000	(1)	(1)	(1)	(1)

[1] Data not yet available.
[2] Conjectural.
[3] Estimate included in total.
[4] Slovak Metallurgical Works.
[5] Exports.
[6] Production less than 1 flask.
[7] January to June, inclusive.
[8] January to September, inclusive.
[9] Production figure published by Metallgesellschaft.

competitive at the lower market price prevailing at the end of the year. The deposit of the Bralorne Mines, Ltd., on Silver Creek east of Tacla Lake began to produce in the latter part of November 1943. This company has a contract with the Metals Reserve Co. which was on a different basis from the Consolidated contract and was in effect when this report was prepared (May 1944).

Germany.—Ordinarily Germany is the largest mercury-consuming country in the world, surpassing even the United States, and there is every reason to believe that it maintained this position in the recent past (for which actual figures are, however, unavailable). Estimates suggest that consumption for 1940 and 1941, at least, may have been two and one-half times the average indicated annual rate of over 26,000 flasks for 1935–39, inclusive. This high consumption rate was due, according to reports, to new plant installations in which the mercury was used as a catalyst in the manufacture of synthetic rubber, to the conversion of other types of electrolytic cells producing chlorine and caustic soda into mercury cells and to new installations for this purpose, and to the expanded use of mercury arc rectifiers for conversion of alternating into direct current in various plants. Germany may also have increased its consumption for the same applications that showed gains in the United States. (See discussion under Consumption and Uses.) Previous Minerals Yearbook chapters on Mercury have pointed out that there was no reason for Germany to economize in the use of this one commodity, a condition which from the German viewpoint marked a pleasant exception to the usual wartime rule.

Italy.—Information concerning the rate of production in Italy continues to be scant. The nominal surrender of Italy to the Allies has not thus far increased the mercury supplies available to the Allied Powers from this source. Italy is one of the two largest mercury-producing countries in the world, but at the end of 1943 all of the producing areas continued in Axis hands because Rome and the region north were occupied by the German army. Most of the Italian production has been coming from the Province of Sienna, Tuscany, and the chief mines are the Monte Amiata and the Siele. These mines are about halfway between Rome and Florence, close enough to the zone of German and Allied fighting south of Rome so that their high rate of production may have been decelerated. It seems logical to believe that Germany has stored ample stocks of mercury for all reasonable requirements at home, having had ready access to the large resources of Italy and Spain since before the war began. Germany's chief concern in regard to Italian mercury, therefore, would appear to be to prevent stocks of metal or mines in good condition from falling into Allied hands. Fortunately the Allies have little present need for obtaining supplies of mercury from Italy.

The other important Italian mine is the Idria, which is far north near Udine, in the Province of Gorizia. The shipping port is Trieste. Reserves in the Monte Amiata mine are reported to be sufficient for several decades at the present rate of production. Those at Idria, on the other hand, are likely to become exhausted in 10 years or so.

Peru.—Production of mercury in Peru has not increased as planned. The Gould rotary, mentioned in the chapter of this series for 1942, was constructed at the Chonta mine of Panaminas, Inc., in the Province of Dos de Mayo, Department of Huanuco. It commenced production on a small scale in 1943. At the old Santa Bárbara mine a few miles south of Huancavelica, a large plant was under construction early in 1944 following delays caused by difficulties in obtaining a permit to ship the parts from the United States. Ore reserves at this property are estimated at 1,000,000 tons, but they contain only 0.12 percent mercury. Small workings in the Huancavelica area were expected to add 10 to 15 flasks monthly to the country's total.

U. S. S. R.—As indicated in the Mercury chapter for 1942, the U. S. S. R. lost its principal mercury-producing area when the mines at Nikitovka, in the Donets Basin, fell into German hands. To make up the deficit caused by loss of domestic production, coupled with increased consumption due to war demands, the U. S. S. R. purchased over 22,000 flasks from the United States under lend-lease arrangements. Extra efforts were made to increase purchases of Chinese metal for shipments by air. The Soviet authorities had undertaken development of non-Ukrainian fields in an attempt to move their areas of dependency into Asia. Properties already in operation in Kirghizia, Kazakhstan, and Siberia are reported to have capacity for supplying as much metal as was formerly obtained from those at Nikitovka. The Soviet picture is greatly improved over that of a year ago, as a large quantity was received from the United States and the Germans have been expelled from the Donets Basin. There thus appears to be little reason to look for a repetition of large Soviet purchases of mercury in the United States.

TIN

By C. E. Nighman and J. B. Umhau

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GENERAL SUMMARY

Despite pressure for more extended application, the use of virgin tin was again depressed in 1943. Actual consumption—46,253 long tons—was 18 percent below that of 1942; and apparent consumption—less than 32,000 tons—was under that of any year since 1910. At the same time, the physical volume of industrial production rose 20 percent over that of 1942 and was more than three times that of 1919, when the apparent tin consumption exceeded 50,000 long tons. Well planned and directed conservation measures, with effective industry cooperation that made these savings possible, also sharpen the outlines of tin's position in our metal economy. Although it is considered essential for numerous purposes and desirable for many others, the stress of wartime circumstances has shown that tin may be dispensed with or its use sharply limited in some applications. These corollaries of the control programs may have far-reaching future consequences, as outlined in subsequent paragraphs.

Imports of metal and concentrates for consumption were 37,675 long tons (tin content), nearly one-third less than in 1942, as the war in the Pacific cut off access to Far Eastern supplies. Arrivals were about 40 percent of the supply available to the United Nations in 1943. Bolivia furnished 21,048 long tons of tin in the form of concentrates or closely 350 tons more than in 1942, despite unsettled internal affairs and lack of a definite sales-price agreement during the last half year. Belgian Congo supplied most of the remainder, consisting of about 4,100 tons of tin in high-grade concentrates and 11,550 tons of pig tin. Export control remained in effect throughout the year. As usual, the major part of tin leaving this country was in the form of tin and terneplate, which declined one-third from the record volume of nearly 600,000 long tons in 1942.

Salient statistics for tin in the United States, 1925-29 (average) and 1939-43

	1925-29 (average)	1939	1940	1941	1942	1943
Production—						
From domestic mines......long tons..	24	34	49	56.3	6.3	[1] 8.2
From domestic smelters........do....	....	....	[2] 1,391	[2] 1,839	[2] 16,168	[1] [2] 21,489
From secondary sources........do....	30,600	26,000	29,700	37,500	33,900	33,800
Imports for consumption:						
Metal........................do....	78,009	70,102	124,810	140,873	26,753	12,030
Ore (tin content)..............do....	175	500	3,000	28,670	28,933	25,645
Exports (domestic and foreign).....do....	1,740	[3] 2,105	[3] 2,164	[3] 1,094	409	1,770
Monthly price of Straits tin at New York:						
Highest...............cents per pound..	70.67	63.50	54.54	53.35	([4])	([4])
Lowest..........................do....	39.79	45.62	45.94	50.16		
Average.........................do....	56.64	50.18	49.82	52.01		
World production..............long tons..	163,000	177,000	237,000	247,000	128,000	122,000

[1] Subject to revision.
[2] Including tin content of ores used direct to make alloys.
[3] Figures for 1939-41 cover foreign only; domestic not separately recorded.
[4] Ceiling price, 52 cents.

Although reductions in consumption did not keep step with the contraction in new supply, tin stood in a satisfactory statistical position at the end of 1943. Industry held 23,766 and Government 54,053 long tons of pig tin, and the tin content of ores awaiting treatment amounted to 31,071 long tons. This represents more than 2 years' needs at the current rate of use. There are indications that Great Britain's position improved materially and that of the U. S. S. R. was not as critical as in the preceding year. It thus became possible early in 1944 to divert part of Bolivia's output (about 11,500 tons tin content) of higher-grade concentrates to the United States. Since there are no foreseeable nearby abnormal drains, supply may exceed demand in 1944 in this country and may be nearly in balance for the United Nations.

As in 1942, controlled sales prices were effective throughout the year and held at 52 cents a pound for Straits tin or equivalent grade. The Government Longhorn smelter set prices for five grades (see section on Prices), with the usual trade differentials. The Bolivian price agreement expired June 30, 1943, and up to June 1944 negotiations for a revised and retroactive settlement base had not been productive. The opinion prevails that an eventual revision will be upward. British purchases from Bolivia will be affected likewise. In view thereof and because their sales price has been under that prevailing in this country, it was announced that as of January 1, 1944, the price of standard tin delivered buyer's work would be raised from £275 (effective since December 1941) to £300.

POST-WAR OUTLOOK

The future course of world virgin-tin consumption was the subject of much speculation in 1943. The consensus appears to be that it will not exceed the pre-war (1930-1939) average of about 150,000 long tons. The part or complete displacement of tin from its customary uses and not scarcity seems to have been the basis of that opinion, because production potential is assessed at the pre-war maximum of 250,000 to 260,000 tons. Since the United States usually consumed about 40 percent [1] of the world production the post-war use in this country would have a heavy weight in the world trend.

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[1] Average consumption in the pentad, 1935-39, was 62,000 long tons and for 8 years between 1927 and 1939 in which actual new metal use was measured, the average was 65,000 tons.

Five tin-bearing products groups took 80 percent or more of domestic consumption in recent years, and the relative amounts assignable to each remained singularly constant. Future trends in these groups are more divergent, but all point toward static or declining use. Tin plate usually took one-half of the new tin supply. Its production probably will increase in the next few years, largely because of growing demand for food in the wake of the United Nations military advances. Exports to our armed forces and for civilian needs also demand standard or high-quality plate. Counterbalancing that rise in metal use is the growing application of thinly coated electrolytic plate and a displacement by tin-free materials, as well as the probable rapid growths in consumption of quick-frozen and dehydrated foods. War time practices doubtless will carry over into peacetimes, especially with the electrodeposited tin plate that alone may reduce consumption 4,000 to 5,000 tons per year, assuming tin-plate production to remain at about a 2-million-ton level.

In the field of bronzes, some contraction from pre-war levels may be anticipated. Shipbuilding—naval and merchant—a large outlet for this class of material, may even decline below that level. Railroad demands are large, but extensive weight economies already effective indicate that little new or make-up tin will be needed. Furthermore, the replacement of the standard bearings by roller and ball-bearing types in railroad and other heavy equipment probably will more than offset any need for additional tin. Enormous expansion of bronze and brass production, first marked in 1940, may also exert a depressing influence on tin consumption because much of the material may be salvageable.

Solder usually occupied second place in use of virgin tin. Experience in 1942–43 has demonstrated that low-tin or tin-free solders may be widely substituted for the usual grades, although special application techniques may be necessary. A potential large requirement for solder (and other tin-bearing materials) exists in the rapidly accumulating demand for automotive vehicles. The satisfaction of that need may be partly completed before a world peace is established, thus modifying the post-war trend, and current experience also has indicated that some tin saving may be effected in this specialized field. In the long run, then, the use of tin in solders appears to be static or even declining.

Among the bearing metals, high-tin babbitts have given way to low-tin war-developed alloys or to virtually tin free substitute metals. The use of thin linings has been extended, and surface treating has lengthened their useful life, both acting to diminish quantity requirements. The use of some substitutes and new practices is likely to persist in the future and will tend to retard consumption.

A substantial quantity of tin, roughly 4,000 tons a year, was used for collapsible tubes and foil. However, a recession in use was noted in recent years. This arose largely by the substitution of aluminum, and it is expected that the trend will not be interrupted. A saving of the order of 3,000 tons a year compared with the pre-war base appears possible. For the major uses the price of tin is relatively unimportant, but in this class of goods and for babbitts and solders it has a considerable influence on the choice between substitutes and tin.

Since it is unlikely that tin will recede from the 50-cent price level for some time, whereas prices of competitive materials may do so, the substitutes will be more strongly entrenched.

In the remaining lesser outlets the usual cyclical variations in consumption will occur. A nearby abnormal increase for a short period to make up for some items that could not be replaced during the war is probable, but on the whole little deviation from recent averages is to be expected.

In sum, war engendered or accelerated decreases in tin uses are of such magnitude and nature that growing industrial production will not be sufficient to effect an upward trend in virgin-tin consumption.

GOVERNMENT TIN PURCHASES

During 1943 purchases of 13,850 long tons of refined tin and 55,000 tons (gross weight) of ore and concentrates were made for Government account. Under the 5-year contract concluded in November 1940, Bolivian producers delivered 47,650 tons of ore and concentrates, and about 650 tons were acquired from French Equatorial Africa and Mexico. Contracts negotiated with African Metals Corporation call for the delivery of all metal produced in the Belgian Congo (less 2,000 tons for Belgium whenever that country may be liberated) and up to 500 tons for African sales. Thereunder, 11,550 tons of refined tin were acquired in 1943. In addition, 6,700 tons (gross weight) of high-grade concentrates were purchased, and the first shipment arrived in June. This material represented an excess of ore production over smelter output, which had been severely hampered by electric power shortage in consequence of drought.

No tin was received from China, but during the year about 1,800 tons were flown to India, and it is expected that about 1,500 tons will reach the United States in 1944. The remainder will be sold in India. About 500 tons of tin were obtained from Portugal through preclusive buying by the U. S. Commercial Co. This agency also concluded—in January 1944—a contract with Williams, Harvey & Co. for the delivery of 20,000 tons of concentrates from the Patiño interests in Bolivia.

The amended price agreement with Bolivian producers expired on June 30, 1943. Producers' demands for a price increase, said to have been as high as 10 cents per pound above the then ruling base figure of 60 cents for contained tin, were unacceptable to the buyers. As a basis for discussion, a price of 63½ cents was suggested. This was not satisfactory to the sellers because the proposed increased smelting charges and penalties for impurities in low-grade material (below 35 percent tin) offset the apparent gain. Negotiations were reopened in December but were again broken off when the Peñaranda government was overthrown near the year end. Nonrecognition of the new de facto government precluded further action, and the status quo was maintained through June 1944. Deliveries, however, have not been interrupted, and it is believed that a new agreement, with some retroactive terms, may be consummated some time after the national election is held on July 2.

CONSERVATION

The achievement of a low in tin use is evidence of the effectiveness of the many control measures directed to that end. During 1943 there were several modifications of limitation and conservation orders, mainly to bring about additional economies or to meet changed circumstances. As electrolytic plate became available, its use was specified for additional products, among them canned milk. It was estimated that the tin requirements for packing evaporated milk in 1942 were around 5,500 long tons in tin plate and about 1,900 tons in solder. Three-quarter-pound electrolytic plate was designated for this use, which would have represented a saving of over 2,000 tons. The effective date of use was deferred from September 30 because test results had not been fully satisfactory and because the can-making machines could not be adapted quickly to the lighter-weight material.

Toward the year end a slight easing of restrictions was noted. They applied mostly to the use of tin and terne plate waste-waste and menders and extended lists of products that might be packed in metal containers. Under an amendment to Conservation Order M-81, beer for use by the armed forces abroad and the Navy offshore may be packed in cans of 0.50 electrolytic plate. Cans for beer first came into prominence in 1935 and were quickly accepted; by 1942, when further use was forbidden, they were a major component of the can manufacturers' output. These and other minor relaxations and the report that rationing of canned goods would be unnecessary by the fall of 1944 prompted the belief that restrictions on tin consumption might then be lifted. The War Production Board, however, made it clear that the conclusion was erroneous.

The practical conclusion of the electrolytic-tinning-plant construction program in 1943 marked the greatest technical advance since the development of the continuous strip cold-rolling [2] process that made it possible. There are now 29 lines at 13 plants, and at rated speed they have a capacity of 48,600,000 base boxes per year or 25 percent more than the total tin-plate production of 1943. Acid baths are used in 17 lines and alkaline in the remainder; all employ flow brightening, and nearly all are equipped to treat the plate chemically during or after quenching. To provide better plant utilization the Weirton Steel Co. employed an electro-tinning line for electro-galvanizing and has reported highly favorable results.

Owing to delays in construction, the volume of electro-deposited plate was still much below that scheduled. It amounted to 19.5 percent of standard coke tin-plate tonnage compared with 3.4 percent in 1942. The average tin weight was 12.2 pounds per short ton and that for standard cokes was 25.8 pounds. Corresponding figures for 1942 were 11.9 and 25.4 pounds, respectively. On the assumption that 40 percent of tin-plate tonnage would be electro-tinned, the tin saving would have been about 4,800 long tons.

In the solder and bronze fields substitutions and down-grading brought about material economies. Although accurate determination is not possible because of lack of complete data and the wide tin range in the various grades, the general effect of down-grading is apparent. For groups of manufacturers who used more than half the total tin (primary plus secondary) contained in solders the approximate tin content declined from 38 percent in 1939 to 29 percent in 1943, and the gross weight of their output dropped more than 25 percent. In babbitt metal the trend was less definite but slightly downward, whereas the gross weight of the output for the same producer groups roughly doubled from 1939 to 1943.

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[2] The last of the hot-rolling mills, the Washington (Pa.) Tin Plate Co., ceased operation, and the plant was dismantled.

INVESTIGATION OF DOMESTIC TIN DEPOSITS

As a part of their strategic mineral programs in 1943, the Bureau of Mines and Geological Survey continued field studies of tin occurrences. The investigations were concentrated in Alaska, which has produced by far the greater part of the tin credited to the United States.

In the Morelock Creek area the quantity of tin disclosed by drilling was disappointing, and the lode source of the cassiterite was not discovered. The lode source was not found in the Tozimoran Creek area, and investigations were extended into the head of Moran Creek. No significant tin deposits were found in the placers of the Circle Hot Springs vicinity. In the Buck Creek and Cape Mountain areas near York and Tin City, prospecting, drilling, and mapping were continued. Three small, tin-bearing veins were found. Exploration in the Lost River area of the western Seward Peninsula (see Minerals Yearbook, 1942, p. 736) afforded the most encouraging results, and it was planned to continue the project in 1944.

In the continental United States tin-bearing deposits near Temescal, Riverside County, Calif., and some tin-bearing pegmatites near Rockford, Ala., were explored further. Additional studies were made of the Meek-Hogan prospect in Kern County, Calif. Geological maps and sections of the above-named areas were printed. Potential tin sources in New Mexico and South Dakota were also examined and sampled. Economically minable deposits were not uncovered by the field work.

The Reconstruction Finance Corporation furnished financial aid to operators in Alabama, South Dakota, and Texas. None of the ventures has been successful. The utter worthlessness of a reputed tin deposit in Oregon was the subject of an extensive report by Nixon.[3]

DOMESTIC PRODUCTION

MINE OUTPUT

Domestic production was again insignificant. The increase of 1.9 tons over that of 1942 was due to the acceptance of distinctly off-grade material by the Metals Reserve Co. To stimulate production and provide a ready market at numerous purchase depots in the United States and Alaska, that Government agency issued the following purchase schedule.

For Alaskan alluvial tin ores or concentrates delivered at Purchase Depot in lots of one (1) long ton or more and containing 50% insoluble tin (Sn) or more, Metals Reserve Company will pay sixty cents (60c) per pound, dry weight, of contained insoluble tin (Sn), less a deduction for treatment charges and metal losses as follows:

Insoluble tin assay	*Deductions per long dry ton of ore or concentrates*
50%	$63.00
51%	62.00
52%	61.00

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[3] Nixon, Earl K., An Investigation of the Reported Occurrence of Tin at Juniper Ridge, Oregon: Oregon Dept. Geol. and Miner. Ind. Bull. 23, 1943, pp. 56.

For each additional increase of one percent (1%) in the insoluble tin assay a further decrease of one dollar ($1.00) will be made in the treatment charge per long dry ton of ore or concentrates.

Within United States tin ores and concentrates, containing eighteen percent (18%) or more insoluble tin, delivered to and unloaded at Purchase Depots, are on the following basis:

Price and Treatment Charges: Payment will be made for the insoluble tin content at sixty cents ($0.60) per pound, less a treatment charge of fifty-seven dollars ($57.00) per dry long ton (2240 pounds) of ore or concentrates containing fifty percent (50%) insoluble tin, with an increase in treatment charge of eighty cents ($0.80) per dry long ton for each one percent (1%) decrease in insoluble tin content below fifty percent (50%) and a decrease in treatment charge of eighty cents ($0.80) per dry long ton for each one percent (1%) increase in insoluble tin content above fifty percent (50%), fractions prorated. This charge is to cover treatment, metal losses and penalties for impurities for ores or concentrates having a combined antimony, arsenic, lead, bismuth and copper content of three percent (3%) or less, in cases where the individual impurity content does not exceed:

Antimony	1.2%	Copper	1.5%
Arsenic	.2%	Bismuth	.2%
Lead	1.2%	Sulphur	3.0%
Zinc	3.0%		

Tin ores and concentrates containing in excess of the above maximum limit of impurities will be penalized as follows:

Penalties for impurities: Combined antimony, arsenic, lead, copper and bismuth —three percent (3%) free, excess at forty-five cents ($0.45) per dry long ton of ore or concentrates for each one-tenth of one percent (0.1%), fractions prorated.

In addition, the impurities shall be penalized individually per dry long ton of ore or concentrates, fractions prorated, as follows:

Antimony—1.2% free, excess at $0.60 for each 0.1% subject to rejection above 2.5%.
Arsenic—0.2% free, excess at $0.60 for each 0.1%.
Lead—1.2% free, excess at $0.60 for each 0.1% (Maximum penalty for lead $10.00 per ton).
Zinc—3.0% free, excess at $0.15 for each 0.1% (Maximum penalty for zinc $10.00 per ton).
Copper—1.5% free, excess at $0.23 for each 0.1%.
Bismuth—0.2% free, excess at $0.45 for each 0.1%.
Sulphur—3.0% free, over 3% to 5% inclusive at $3.00 per ton, over 5% to 10% inclusive at $6.00 per ton, over 10% to 15% inclusive at $9.00 per ton, over 15% at $12.00 per ton.

Quantity: Metals Reserve Company will accept tin ore or concentrates at its Purchase Depots in lots of not less than five (5) long tons.

Rejection: Metals Reserve Company may reject any lot of ore or concentrates which does not conform to the requirements and specifications as herein set forth. In any event, Metals Reserve Company will not accept delivery of ore or concentrates containing less than eighteen percent (18%) insoluble tin. Insoluble tin shall consist of all tin that is *not* soluble in hot hydrochloric acid of 20° B. strength.

Mine production of tin (content) in the United States, 1939-43, by States

Year	Long tons				Value
	Alaska	South Dakota	Other States [1]	Total	
1939	33	0.5	0.5	34	38,100
1940	46	2	1	49	54,900
1941	46.8	1.4	8.1	56.3	65,600
1942	2.8	1.4	2.1	6.3	7,300
1943	[2] 2.4	.6	5.2	[2] 8.2	[2] 9,600

[1] 1939-40: Montana and New Mexico; 1941; Alabama, Montana, and New Mexico; 1942: Alabama, California, Nevada, and New Mexico; 1943: California, Nevada, and New Mexico.

[2] Subject to revision.

SMELTER OUTPUT

The Longhorn smelter output of 20,728 long tons of pig tin was substantially below the expected amount and was about 70 percent of the present rated capacity.[4] During the "breaking in" period the smelter had used much high-grade ore. When the transition to Bolivian ores took place—about March—monthly output dropped to less than half the high of 2,611 long tons in January and remained relatively low for about 6 months. In September it passed the 2,000-ton mark and remained at that level through December. As indicated, the lag was due to the metallurgical problems involved and the lack of sufficient capacity to handle charges heavily burdened with low-grade and highly impure Bolivian ores. The average tin content of such ore received in 1943 was 38.7 percent or little more than half that of the usual run of Far Eastern and Belgian Congo concentrates. Better results in throughput and recovery are anticipated in 1944 owing to improvements in the processing of off-grade material and the acquisition of high-grade concentrates from the Belgian Congo, with a large share of Patiño's Bolivian production that contains about 58 percent tin.

The metallurgical difficulties were reflected in production of three new grades. A list of grades made by the Longhorn smelter with percentage ranges in tin content follows:

3 Star	99.80 and over.
2 Star	99.50–99.64.
Class C	99.65–99.79.
1 Star	99.00–99.49.
Grade F	Less than 99.00.

Shipments were 26,725 long tons, of which industrial users received about 12,600 tons and the remainder was distributed to Government agencies and the Metals Reserve Co. warehouses at St. Louis and Chicago.

Privately owned plants treated tin ores on a small scale in 1943 and recovered 761 long tons of tin in the form of pig tin, and alloys (mostly solder) made direct from the ores. In 1942 the total recovered was 472 tons. Only three companies reported production in 1943—American Smelting & Refining Co., Nassau Smelting & Refining Co., and Vulcan Detinning Co.

SECONDARY TIN

The total recovery of secondary tin was 33,800 long tons in 1943, virtually unchanged from 1942. About 85 percent of the tin recovered was contained in lead- and copper-base alloys, from which it is usually not extracted as metal. In 1943, as a wartime measure, however, the National Lead Co., acting as agent for the Metals Reserve Co., recovered about 40 long tons of the tin from type-metal scrap; and the Tin Salvage Institute, another agent, obtained about 230 tons from collapsible tubes.

Although there was little change in the quantity of tin recovered, there were pronounced quantitive differences in the source materials. The quantity of clean tin-plate clippings, usually the source of most reclaimed metal, dropped more than 25 percent but was more than offset by the increased tonnage of old tin cans sent to detinning plants. Because of the tremendous increase in shipbuilding and armament production, the volume of bronze and brass increased manyfold and counterbalanced not only the smaller quantities but lower grades of white metals available. There was, consequently, an increase of about 1 percent in the recovered tin contained in alloys.

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[4] Secretary of Commerce Jesse H. Jones announced in December 1943 that $350,000 had been made available to the Tin Processing Corporation for additional equipment. This was said to include dust-precipitation and accessory devices that would improve recovery from low-grade Bolivian ores.

A description of the plant, by R. H. Ramsey, accompanied by photographs and flow sheets, appeared in the Engineering and Mining Journal, vol. 144, No. 6, June 1943, pp. 56–61.

Secondary tin recovered in the United States, 1925–29 (average) and 1939–43

Year	Tin recovered at detinning plants			Tin recovered from all sources			
	As metal (long tons)	In chemicals (long tons)	Total (long tons)	As metal (long tons)	In alloys and chemicals (long tons)	Total	
						Long tons	Value
1925–29 (average)	900	2,000	2,900	7,500	23,100	30,600	$38,034,120
1939	3,600	600	4,200	4,000	22,000	26,000	29,276,600
1940	3,700	600	4,300	4,500	25,200	29,700	33,102,400
1941	4,500	950	5,450	5,300	32,200	37,500	43,722,700
1942	4,700	200	4,900	5,200	28,700	33,900	39,487,700
1943	3,900	200	4,100	4,700	29,100	33,800	39,332,800

Detinning-plant output dropped to 3,900 long tons or 17 percent below the high of 1942. The change was a composite of the decline in tinplate output and of the lighter coatings used on electrotinned plate. The last-named factor will have much greater weight in 1944 in consequence of the expected large increase in electrolytic plate use and corresponding drop in drosses arising from the hot-dipping processes.

The War Production Board announced in February that the program for the construction of 10 federally financed detinning plants had been deferred. Later, however, approval was granted for the erection of a large plant at Birmingham, Ala. It has a reported yearly capacity of 20,000 long tons of cans and was expected to begin operation in February 1944. The used-can salvage campaign attained little better results in 1943 than in 1942. Collections probably did not exceed one-third the potential and were said to be less than half the capacity of the privately owned commercial plants. Tin recovered from old cans was about 1,690 long tons or more than three times the 1942 output. Further details will be found in the chapter on Secondary Metals—Nonferrous.

CONSUMPTION

APPARENT CONSUMPTION

The apparent consumption of primary tin, calculated by adding smelter production to net imports, declined 25 percent in 1943, reaching the lowest level in more than 40 years. This method of reckoning consumption excludes all changes in metal stocks held by consumers and the Government, and in times of extraordinary movement, such as the period 1940–43, may present a highly distorted picture. Frequently, however, basic data for more accurate calculation are unavailable, hence apparent consumption statistics offer the only indicator of long-term trends. The data for 1910–38 were published in Minerals Yearbook, 1939 (p. 680); those for 1938–43 follow. Figures for 1931 to 1941, inclusive, do not include exports of domestic tin;

those for 1942 and 1943 include domestic exports, which were 244 and 398 long tons, respectively.

Apparent consumption of tin, 1938-43, in long tons

1938	49, 494	1941	141, 618
1939	67, 997	1942	42, 512
1940	123, 537	1943	31, 749

CONSUMPTION BY USES

The following tables, prepared from reports made to the Bureau of Mines, show actual consumption of tin measured at the point where it enters the process and where it emerges in the first stage of manufacture. The difference of about 4,000 tons represents losses, tin in scrap, and net changes in the quantity in process. The moderate decline of 6 percent from the 1942 total consumption indicates an approach toward a minimum consumption for essential purposes when industrial output is mainly war matériel.

Consumption of primary and secondary tin in the United States, 1939-43, in long tons

	1939	1940	1941	1942	1943
Stocks on hand Jan. 1	25, 260	29, 025	56, 999	[2] 67, 421	[3] 43, 853
Net receipts during year [1]	89, 018	128, 030	149, 123	65, 568	75, 101
Available supply	114, 278	157, 055	206, 122	132, 989	118, 954
Stocks on hand Dec. 31	29, 025	56, 999	[2] 67, 421	[3] 43, 853	[5] 34, 735
Total processed during year	85, 253	100, 056	138, 701	89, 136	84, 219
Intercompany transactions in scrap (tin content)	2, 390	2, 190	2, 936	2, 547	2, 889
Total consumed in manufacturing	82, 863	97, 866	135, 765	86, 589	81, 330
Plant losses	435	712	1, 070	902	1, 000
Tin content of manufactured products	82, 428	97, 154	134, 695	85, 687	80, 330
Primary	[4] 66, 583	[4] 72, 324	[4] 103, 086	56, 288	46, 253
Secondary	15, 845	24, 830	31, 609	29, 399	34, 077

[1] 1939: Primary, 70,732; secondary, 4,976; terne, 1,171; scrap, 12,139. 1940: Primary, 98,125; secondary, 5,409; terne, 1,086; scrap, 23,410. 1941: Primary, 114,281; secondary, 6,879; terne, 1,851; scrap, 26,112. 1942: Primary, 33,126; secondary, 5,096; terne, 405; scrap, 26,941. 1943: Primary, 40,548; secondary, 4,462; terne, 188; scrap, 29,903.

[2] Not including 2,700 tons in transit or in warehouses.

[3] Not including 78 tons in transit.

[4] Includes small tonnage of secondary pig tin.

[5] Not including 316 tons in transit or in warehouses.

Changes in the tin-consumption pattern noted in the 1942 review were accentuated in major items during 1943. In the use of virgin metal tin plate remained in first place, consuming 47 percent in 1943. The drop of 6,838 tons below the 1942 figure also brought use for this purpose to the lowest recorded in recent years. The increased replacement of hot-dipped by electrolytic plate had a marked effect. Total tin-plate production was 19 percent less than in 1942, whereas tin use declined 24 percent. The continuance of degradation and substitution was again noted with respect to solder. For the first time since 1935, less primary than secondary tin went into its manufacture. Compared with 1942 it was down 27 percent, whereas secondary rose 10 percent and total use went off 9 percent. With increased demand for white-base antifriction metals—about 17 percent—the use of tin increased 27 percent, virtually all of which was in secondary form. The record production (especially of ships, tanks, and motorized field equipment) brought bronze and brass into an entirely new position as tin consumers. From 1927 to 1939 they took little more than 5 percent of the virgin tin in any year; in 1943 they used 24 percent. Usually less secondary than primary metal is employed, but in 1943 the ratio was 1 2/3:1. The quality of secondary tin used was the greatest recorded for any product, and total consumption for the first time exceeded that of tin plate. Since bronzes seldom contain more than 10 percent tin, and every effort has been made to employ the low-content alloys the many-fold increase over peacetime needs in the output of this alloy class is evident, and it appears probable that post-war needs may be met to a considerable extent from salvaged material.

Consumption of tin in the United States, 1941–43, by finished products (tin content) in long tons

Product	1941			1942			1943		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
Tin plate	[1] 44,854	([1])	44,854	28,522	....	28,522	21,684	42	21,726
Terneplate	917	1,129	2,046	339	543	882	100	334	434
Solder	18,064	10,141	28,225	7,228	6,696	13,924	5,292	7,384	12,676
Babbitt	7,495	3,104	10,599	3,195	2,904	6,099	3,217	4,536	7,753
Bronze and brass	10,067	13,103	23,170	10,646	17,009	27,655	11,180	18,575	29,755
Collapsible tubes	4,233	212	4,445	1,048	51	1,099	282	309	591
Tinning	3,987	145	4,132	2,764	251	3,015	2,690	324	3,014
Foil	4,292	....	4,292	576	....	576	227	145	372
Chemicals (other than tin oxide)	280	690	970	36	210	246	112	299	411
Pipe and tubing	1,325	([2])	1,325	143	18	161	82	118	200
Tin oxide	995	495	1,490	84	47	131	....	....	....
Type metal	287	1,528	1,815	40	1,113	1,153	28	1,053	1,081
Galvanizing	863	104	967	82	....	82	4	....	4
Bar tin	1,526	607	2,133	601	121	722	685	276	961
Miscallaneous alloys	480	137	617	558	256	814	360	566	926
White metal	[3] 2,463	[3] 98	[3] 2,561	[4] 83	[4] 156	[4] 239	90	[5] 55	[5] 145
Miscellaneous	938	116	1,054	343	24	367	220	61	281
	103,086	31,609	134,695	56,288	29,399	85,687	46,253	34,077	80,330

[1] Primary includes small tonnage of pig tin derived from detinning operations; Bureau of Mines not permitted to publish separate figures.

[2] Small quantity included under "Miscellaneous."

[3] Includes 454 tons of primary and 20 of secondary for Britannia ware and 64 tons of primary and 8 of secondary for pewter.

[4] Includes 9 tons of primary and 2 of secondary for Britannia ware and 2 tons of primary for pewter.

[5] Includes 5 tons of secondary for pewter.

In the remaining use fields the general downward trend that was pronounced in 1942 flattened and probably will stabilize near present levels.

The tonnage of virgin tin consumed was reduced 10,000 tons, but that of secondary was increased 5,000 tons with respect to the preceding year. The net effect was a 6-percent reduction, as the full effect of the wartime controls was felt.

FOREIGN TRADE [5]

Imports of tin concentrates and exports of tin plate were the principal elements of the foreign trade of the United States during the year. Pig tin, which had dominated the import field for many years, gave way both in quantity and value to tin concentrates. As this country was denied access to the normal Asiatic sources by the war in the Pacific, metallic tin imports dropped 55 percent to 12,030 long tons, of which 96 percent arrived from the Belgian Congo. Most of the remainder was acquired through preclusive buying in Portugal.

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[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Imports of concentrates were consigned almost entirely to the Longhorn Smelter at Texas City, Tex. The tin content (25,645 long tons) was 11 percent below the 1942 record of 28,933 tons (revised figure). Bolivia was again the principal source, supplying 21,048 tons compared with 20,750 in 1942 (revised figure). Partly replacing the 1942 high-quality arrivals from the Netherlands East Indies were 4,094 tons from the Belgian Congo and 291 tons from French Africa. Mexico supplied 212 tons of very low grade material.

Foreign trade of the United States in tin and tin concentrates, 1939-43

Year	Imports				Exports of tin (metal)[1] (long tons)
	Tin (metal)		Tin concentrates (tin content)		
	Long tons	Value	Long tons	Value	
1939	70,102	$70,590,764	500	$418,004	2,105
1940	124,810	128,294,410	3,000	2,687,154	2,664
1941	140,873	149,569,328	28,670	27,671,689	1,094
1942	[2] 26,753	[2] 29,311,113	[2] 28,933	21,422,896	[3] 165
1943	12,030	13,089,540	25,645	15,352,275	[3] 1,372

[1] Imported as pigs, bars, etc., and exported as such.
[2] Revised.
[3] In addition 244 tons of ingots, pigs, etc., were exported in 1942 and 398 tons in 1943; accounted for as domestic exports in "exports of miscellaneous tin manufactures."

Tin[1] imported for consumption in the United States, 1942-43, by countries

Country	1942		1943	
	Long tons	Value	Long tons	Value
Belgian Congo	11,225	$11,916,238	11,550	$12,686,414
Brazil	(2)	156		
British Malaya	7,791	8,634,882	5	6,180
Canada	4	1,353	1	1,025
China	3,625	4,017,470		
India and Dependencies			(2)	57
Netherlands Indies	3,922	4,485,899		
New Zealand			110	6,750
Panama	(2)	100		
Portugal	99	159,630	364	389,105
United Kingdom[3]	87	95,385		
	26,753	29,311,113	12,030	13,089,540

[1] Bars, pigs, blocks, grain, granulated, or scrap, and alloys, chief value tin, n. s. p. f.
[2] Less than 1 ton.
[3] United Kingdom of Great Britain and Northern Ireland.

Foreign trade in tin plate, taggers tin, and terneplate in various forms, 1939-43, in long tons

Year	Tin-plate scrap		Tin-plate circles, strips, cobbles, etc., (exports)	Waste-waste tin plate (exports)	Tin plate, taggers tin and terneplate	
	Imports	Exports			Imports	Exports
1939	12,633	10,204	6,552	9,132	99	311,016
1940[1]	16,615	3,536	4,590	6,091	137	383,328
1941[1]	22,600	180	4,952	8,321	109	354,940
1942[1]	24,082		1,333	3,230	134	595,020
1943[1]	19,591	27	1,607	50	101	396,550

[1] In addition, 15,153 long tons of terneplate clippings and scrap valued at $474,374 were exported in 1940, 751 tons valued at $43,545 in 1941, 76 tons valued at $4,350 in 1942, and 56 tons valued at $5,253 in 1943; not separately classified before Jan. 1, 1940.

Foreign trade in miscellaneous tin manufactures and tin compounds, 1939-43

Year	Miscellaneous tin manufactures		Tin compounds (pounds)	
	Imports [1]	Exports [2]	Imports	Exports
1939	$20, 106	$1, 098, 140	5	204, 362
1940	12, 429	706, 425	271	131, 019
1941	2, 266	1, 456, 353	7, 224	137, 424
1942	[3] 949	591, 937		117, 191
1943	[3] 2, 425	666, 476		25, 042

[1] Includes tin manufactures, n. s. p. f., tinfoil, tin powder, flitters, and metallics.
[2] Includes tin dross and tin-bearing scrap material other than tin-plate scrap.
[3] In addition, 505,346 pounds of tin dross, skimmings, and residues valued at $63,978 were imported in 1942, and 45,943 pounds valued at $4,595 in 1943.

Tin and terneplate constituted the major export commodities. Foreign shipments receded 33 percent from the 1942 record but remained at an exceptionally high value. A considerable part of the decline is attributable to the anti-U-boat campaign that had progressed far in the reopening of sea lanes and the building of nearly 20 million tons of merchant ships in the United States alone. Among the largest declines were shipments to Argentina, possibly because of our strained relations; to Australia, where tin-plate production was reported to have increased; to Egypt; to Iran, which had probably transshipped a sizable part of its receipts to Russia; and to the U. S. S. R., as it became less necessary to duplicate shipments via the extremely hazardous Murmansk route.

Tin plate, terneplate (including long ternes), and taggers tin exported from the United States, 1942-43, by principal countries

Country	1942		1943	
	Long tons	Value	Long tons	Value
Africa:				
British East Africa	9, 167	$957, 913	3, 467	$365, 901
Southern Rhodesia	1, 167	134, 567	495	64, 836
Union of South Africa	31, 325	3, 871, 715	23, 593	2, 745, 819
Argentina	56, 958	6, 938, 416	25, 292	3, 156, 685
Australia	132, 709	16, 490, 343	97, 260	11, 689, 051
Brazil	37, 600	4, 495, 220	42, 664	5, 103, 297
British Malaya	683	64, 252		
Canada	64, 146	7, 255, 969	38, 744	4, 315, 091
Ceylon	766	118, 313	1, 275	126, 115
Chile	10, 683	1, 277, 202	6, 862	848, 156
China	102	13, 491	1, 147	146, 936
Colombia	1, 260	173, 977	3, 908	457, 512
Cuba	14, 003	1, 807, 870	10, 197	1, 298, 730
Egypt	49, 303	4, 776, 028	16, 071	1, 526, 195
India and Dependencies	17, 821	1, 907, 633	20, 079	1, 984, 008
Iran	28, 384	3, 050, 628		
Madagascar			1, 032	120, 806
Mexico	14, 371	1, 853, 260	13, 646	1, 735, 744
Morocco, French			2, 951	335, 478
Netherlands Indies	6, 491	733, 848		
New Zealand	24, 917	2, 966, 703	29, 381	3, 525, 542
Palestine and Trans-Jordan	5, 118	566, 629	908	93, 868
Paraguay	4, 535	563, 280	2, 650	317, 897
Peru	3, 169	356, 960	1, 634	202, 323
Portugal	1, 758	261, 553	1, 360	169, 845
Turkey			152	19, 117
U. S. S. R.	50, 058	6, 366, 974	29, 881	3, 569, 629
United Kingdom [1]	2, 409	278, 714	85	10, 032
Uruguay	12, 478	1, 537, 790	16, 344	1, 995, 187
Venezuela	2, 254	320, 868	1, 458	175, 092
Other countries	10, 141	1, 521, 376	4, 014	514, 791
	593, 776	70, 661, 492	396, 550	46, 613, 683

[1] United Kingdom of Great Britain and Northern Ireland.

PRICES

The price of tin remained stabilized at established Government maximums or ceilings throughout 1943. In the United States Grade A pig tin (which includes Straits brand), the principal grade sold, was 52 cents a pound, ex dock port of entry or f. o. b. producers' plant. A revised schedule entitled Maximum Price Regulation 17 (Tin), which became effective September 22, 1943, made no important changes in the ceiling but set up a more equitable pricing of all grades and brands not conforming to Grade A specifications. The maximum prices by grades and brands are as follows:

Grade A. 99.80% or higher, meeting specifications set forth in M. P. R. No. 17	52.00c.
Following brands of pig tin will be considered as qualifying as Grade A: Longhorn 3-Star, Chempur, Pyrmont, Straits Trading, O. T. Lempriere & Co., E. S. Coy (Penang), Billiton, Mellanear (Guar. 99.9%), Hawthorne Refined, Banka, Union Min. du H. Katanga, M and T No. 1, M and T Electrolytic Refined, Vulcan American Refined, Vulcan Electrolytic.	
Grade B. 99.80% or higher, not meeting specifications for Grade A, providing arsenic content does not exceed 0.05%	51.87½c.
Grade C. 99.65% to 99.79% and 99.80% or higher, not meeting specifications for Grade A or Grade B	51.62½c.
Grade D. 99.50% to 99.64% (includes Longhorn 2-Star)	51.50c
Grade E. 99.00% to 99.49% (includes Longhorn 1-Star)	51.12½c.
Grade F. Below 99% pure (for tin content) (includes Longhorn No-Star)	51.00c.

Tin price data, 1925–29 (average) and 1939–43

	1925–29 (average)	1939	1940	1941	1942	1943
Average prices:						
New York:[1]						
Straits tin............cents per pound....	56.64	50.18	49.82	52.01	[2] 52.00	[2] 52.00
99.75-percent tin (English refined)..do..	([3])	[4] 47.84	[5] 48.79	([6])	[7] 51.625	[7] 51.625
99-percent tin..........................do..	55.50	[6] 46.35	[8] 49.98	51.26	[9] 51.125	[9] 51.125
London:[10]						
Standard tin............£ per long ton...	254.6	226.3	256.6	[11] 261.6	[12] 275.0	[12] 275.0
Do.............cents per pound [13]..	55.17	44.81	[14] 43.87	[14] 47.09	49.54	49.54
Premium allowed over standard:						
Straits..............£ per long ton..	5.1	([3])	([3])	([3])	([3])	([3])
Banka...........................do....	6.9	([3])	([3])	([3])	([3])	([3])
English.........................do....	—.7	([3])	([3])	([3])	([3])	([3])
Price indexes (1925–29 average=100):						
Straits tin (New York)......................	100	89	88	92	92	92
Copper (New York)........................	100	75	77	80	80	80
Lead (New York)............................	100	68	69	78	87	87
Nonferrous metals [15]....................	100	79	82	85	87	87
All commodities [15]......................	100	79	80	89	101	105

[1] American Metal Market.
[2] Maximum for Grade A, 99.8 percent or higher (includes Straits).
[3] Data not available.
[4] 10-month average.
[5] 7-month average.
[6] January–August, nominal; September–December, 51.62 cents.
[7] Maximum for Grade B, 99.75–99.79 percent, and Grade C, Cornish refined
[8] 9-month average.
[9] Maximum for Grade D, 99.0–99.74 percent.
[10] Metal Bulletin, London, as compiled by International Tin Research and Development Council.
[11] 11-month average.
[12] British Government maximum price.
[13] Conversion of British quotations into American money based upon average rates of exchange recorded by the Federal Reserve Board of the Treasury.
[14] Based upon free exchange rate.
[15] Based upon price indexes of U. S. Department of Labor.

The London price of £275 established on December 9, 1941, was unchanged throughout 1943. However, on January 1, 1944, the Ministry of Supply announced an increase of £25 per ton to £300 for metal ranging between 99 percent and 99.75 percent tin content. The prices for other grades will carry the usual differentials. The announcement explained that:

> Since December 9, 1941, there has been a general upward movement in the course of tin in the Ministry of Supply, resulting in a substantial burden on public funds at the present price, and the increase now announced takes account of the present and anticipated level of costs of the supply from the different sources available to the Ministry while the present abnormal conditions in the Far East continue.

Free world prices continued to be nonexistent. In some countries, such as Spain and Portugal, exorbitant prices have obtained because of competition among belligerents.

STOCKS

Total year-end stocks of primary tin plus tin content of the ore supply in the United States in 1943 were 14 percent below 1942. The Government held 80 percent and private industry the remainder. Nearly 60 percent of the quantity held by the Government was in the form of metallic tin and the balance in ores and concentrates. Government stocks of pig tin were depleted 16 percent, and industrial stocks declined 27 percent. Virtually all of the industrial stocks were in the form of metal; only a small quantity was in ores awaiting treatment at privately owned plants. The total quantity on hand at the end of 1943 was equivalent to about 2 years' supply at the rate of consumption in 1943.

During 1943 the Bureau of Mines canvassed tin consumers to determine stocks and use. According to these reports, the consuming industry had 22,900 tons of primary pig tin at plants at the end of 1943, including 13,600 tons held by tin-plate manufacturers. The industry also had 316 tons of primary tin in transit or warehoused in addition to 886 tons of secondary pig tin on hand at the end of the year.

Stocks of virgin pig tin in the United States, Dec. 31, 1939–43, in long tons

	1939	1940	1941	1942	1943
Location of stocks:					
Afloat to United States [1]	12,663	22,627	[2] 15,000	[2] 900	[2] 1,650
At landings in New York [1]	2,415	6,106	3,129	([3])	([3])
In licensed warehouses in New York [1]	887	3,073	371		
Total visible supply [1]	15,965	31,806	18,500	[2] 900	[2] 1,650
Consumers' stocks [4]	21,111	46,574	[5] 56,922	[6] 31,226	[7] 23,227
Total stocks on hand	[8] 37,076	[8] 78,380	[8] 75,422	[8] 32,126	[8] 24,877

[1] As reported by Commodity Exchange, Inc.

[2] Estimated.

[3] Not available.

[4] As reported to the Bureau of Mines; does not include tin in process or secondary pig tin.

[5] Includes 2,700 tons in transit in the United States and at other warehouses not contained in figures above for "at landings" and "in licensed warehouses."

[6] Includes 78 tons in transit and 84 tons held by jobbers.

[7] Includes 316 tons in transit and at other warehouses and 50 tons held by jobbers..

[8] Exclusive of Government purchases delivered for stock piling or at Texas City smelter.

WORLD ASPECTS OF TIN INDUSTRY

WORLD MINE PRODUCTION

Official tin-production statistics have been available from very few countries since 1939, but it appears probable that total output was even lower than in 1942, which was perhaps not half that of 1941. Production accessible to the Allies was again below expectations, but somewhat greater than in the preceding year, and was approaching a balance with their minimum demands. In the Far East the Allies took the offensive, especially against Japanese shipping, with a probable retardant effect on production.

World mine production of tin (content of ore), 1925–29 (average) and 1938–43, by countries, in long tons

[Compiled by B. B. Waldbauer]

Country	1925–29 (average)	1938	1939	1940	1941	1942	1943
Restricted production:							
Belgian Congo	967	8,820	8,964	12,482	16,006	16,844	18,700
Bolivia (exports)	37,169	25,484	27,211	37,940	42,199	38,293	40,312
Indochina	691	1,599	1,470	2,098	[1] 1,430	[1] 1,400	[1] 1,000
Malay States:							
Federated	54,606	41,206	49,525	85,384	[1] 78,000	[1] 15,000	[1] 15,000
Unfederated	2,206	2,041	1,994				
Straits Settlements	25	114	206				
Netherlands Indies	33,266	27,299	27,755	43,193	[1] 51,000	[1] 10,000	[1] 7,500
Nigeria	8,319	8,977	9,427	12,012	[1] 15,000	[1] 12,500	13,680
Thailand (Siam)	8,204	14,704	[2] 17,325	17,447	[1] 16,250	[1] 12,000	[1] 7,000
Total signatory countries	145,453	130,244	143,877	210,556	220,000	106,000	103,000
Unrestricted production:							
Argentina	32	1,886	1,655	1,481	921	998	[1] 700
Australia	2,830	3,329	3,500	(3)	(3)	[1] 3,000	[1] 2,800
Burma	2,228	7,100	8,536	[1] 5,500	(3)	(3)	(3)
Cameroun, French	------	242	255	(3)	300	400	(3)
China	[2] 7,085	[2] 11,605	[2] 10,422	[2] 6,249	[1] 8,000	[1] 7,000	[1] 5,000
Germany	98	[1] 300	[1] 300	(3)	(3)	(3)	(3)
Italy	------	271	229	(3)	(3)	(3)	(3)
Japan	625	2,186	[1] 1,700	(3)	(3)	(3)	(3)
Mexico	2	249	289	345	212	365	426
Morocco, French	4	27	(3)	(3)	(3)	(3)	(3)
Peru	------	103	47	72	45	22	(3)
Portugal [4]	625	1,037	1,486	1,721	2,330	2,670	3,460
Portuguese East Africa	5	4	7	8	(3)	(3)	(3)
Rhodesia:							
Northern	------	3	------	16	10	(3)	(3)
Southern	15	267	451	(3)	239	162	(3)
Somaliland, Italian	------	------	[1] 40	(3)	(3)	(3)	(3)
South-West Africa	149	164	156	137	120	110	158
Spain	145	138	106	100	103	239	456
Swaziland	138	122	114	103	(3)	(3)	(3)
Tanganyika	22	241	229	258	251	(3)	(3)
Uganda	98	399	346	[3] 305	[3] 315	[3] 311	(3)
Union of South Africa	1,174	558	482	518	463	500	[1] [5] 1,150
United Kingdom [4]	2,658	1,999	2,579	2,618	2,441	2,196	2,214
United States	24	95	34	49	56	6	8
Total nonsignatory countries	17,957	32,325	33,000	26,000	27,000	22,000	19,000
Grand total	163,000	163,000	177,000	237,600	247,000	128,000	122,000

[1] Estimate.
[2] Exports.
[3] Estimate included in the total.
[4] Restricted production basis from 1934–36, inclusive.
[5] Estimate includes Rhodesia, Swaziland, Tanganyika, and Uganda.

WORLD SMELTER PRODUCTION

Production from the world's smelters is likewise unknown but was probably above that of 1942. Because of a water and power shortage in the Belgian Congo output decreased about 2,000 tons. In China output may have been below the estimated figure, owing to Japanese air attacks on the Papu (PKMA) smelter and low mine production in Yunnan Province. These changes probably were counterbalanced by the 6,000-ton rise in smelter output of the United Kingdom and the United States.

World smelter production of tin, 1925–29 (average) and 1938–43, by countries, in long tons

[Compiled by B. B. Waldbauer]

Country	1925–29 (average)	1938	1939	1940	1941	1942	1943
Argentina	--------	2,093	1,080	881	768	709	552
Australia	2,952	3,229	3,300	(2)	[1] 5,000	[1] 3,000	[1] 2,500
Belgian Congo	--------	2,283	2,124	7,832	15,000	[1] 14,400	[1] 12,000
Belgium [1]	720	[3] 6,700	[3] 3,100	(2)	(2)	(2)	(2)
British Malaya	[4] 88,855	[4] 63,746	[4] 81,536	[3] 126,945	[1] 125,000	[1] 10,000	[1] 15,000
Canada	--------	--------	--------	--------	29	560	347
China	[8] 7,080	11,200	10,850	[1] 13,000	[1] 10,000	[1] 7,000	[1] 5,000
Germany [6]	3,444	3,000	[1] [3] 3,600	(2)	(2)	(2)	(2)
Italy	--------	271	229	(2)	(2)	(2)	(2)
Japan	606	1,900	[1] [3] 2,000	[1] 1,800	(2)	[1] 4,000	(2)
Mexico	(2)	(2)	90	116	150	(2)	(2)
Netherlands	[7] 1,000	[1] 26,400	[1] 14,600	2,967	(2)	(2)	(2)
Netherlands Indies [5]	14,749	7,207	13,941	22,035	[1] 23,000	[1] 5,000	[1] 5,000
Norway	(2)	254	283	(2)	(2)	(2)	(2)
Portugal	[8] 2	39	30	781	1,481	2,381	3,058
Spain	--------	120	140	114	87	100	(2)
Thailand (Siam)	[9] 113	--------	(2)	(2)	(2)	(2)	(2)
Union of South Africa	--------	--------	--------	(2)	143	535	[10] 526
United Kingdom [1]	45,800	36,200	37,400	(2)	40,000	30,000	31,026
United States	--------	--------	--------	[11] 1,391	[11] 1,839	[11] 16,168	[11] 21,489
	165,000	164,500	174,100	(2)	(2)	(2)	(2)

[1] Estimate. [2] Data not available. [3] Yearbook of American Bureau of Metal Statistics.
[4] Exports plus difference between carry-over at end and beginning of year.
[5] Exports. [6] Includes production of some secondary tin. [7] Estimated production in 1929.
[8] Average for 1926–27. [9] Average for 1926–28. [10] January to September, inclusive.
[11] Including tin content of ores used direct to make alloys.

INTERNATIONAL TIN-CONTROL SCHEME

Production quotas were unchanged from those set up under the fourth control agreement that has been effective since January 1, 1942. Allowable production at 105 percent of the standard is tantamount to unrestricted output. From some quarters there was criticism of Bolivia's share of 49,106 tons (105 percent of standard), but that country has failed to meet its quota for several years.

A historical review of the formation and activities of the International Tin Committee and of the buffer stocks appeared in the August–October 1943 issues of Tin and were reprinted in American Metal Markets of September 16, October 30, and November 13. The United States Department of Justice, Antitrust Division, according to newspaper reports in late July, was "looking into" the monopolistic aspects of the tin cartel. The Senate Subcommittee on War Mobilization of the Committee on Military Affairs published, early in 1944, a study of materials from the files of the U. S. Department of Justice relating to activities of cartels and monopolies.[6] A reference to the International Tin Committee is carried on page 24.

In reaction to the not fully favorable future outlook for tin the Tin Research and Development Council, an auxiliary of the International Tin Committee, prepared plans for long-term research and propaganda. The tentative scheme, according to reports, envisaged a 10-year development period with annual average expenditures of about £300,000. Broad research and semicommercial scale studies were included, as well as technical press propaganda and the establishment of 10 service bureaus in important tin-consuming countries.

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[6] Economic and Political Aspects of International Cartels, a study made for the Subcommittee on War Mobilization of the Committee on Military Affairs, U. S. Senate, 78th Cong., 2d sess., Monograph 1 Government Printing Office, Washington, 1944, 82 pp.

REVIEW BY COUNTRIES

Australia.—Tin output in Australia was considerably below expectations, with only about 2,800 tons produced in 1943. Manpower and materials shortages have been assigned as causes, but in all probability lack of economically minable resources has been the primary reason. The Commonwealth Government, as well as that of some of the States, provided financial and other assistance. The Government has acquired the mine and plant of the Mount Bischoff Tin Mining Co. in Tasmania, which resumed operations upon a compulsory basis. A dredge that had previously operated in Victoria was acquired by the Tasmania controller of mineral production for alluvial mining in the Ringarooma Valley.

Belgian Congo.—Although it had been expected that 21,500 tons of tin in ore would be produced in 1943, the mine output of the Belgian Congo was 18,000 tons in 1943 compared with 16,800 in 1942. Mining was retarded owing to the driest season on record, lack of labor and materials, and some reluctance of the tin-gold producers to change over completely to tin mining. At some of the mines lower-grade material was being mined in 1943.

The United States imported 11,550 tons of metallic tin from the Belgian Congo in 1943 (11,224 in 1942) and 4,094 tons in ore and concentrate. None was lost at sea in 1943 through enemy action, but a cargo of metallic tin was lost as the result of a marine accident in February.

Exports of metallic tin from the Belgian Congo to African destinations have been about 490 tons annually.

Bolivia.—Bolivia exported concentrates and ore containing 40,312 long tons of tin in 1943 compared with 38,293 in 1942, 42,200 in 1941, and 46,343 in the peak production year 1929. The United States was the destination of 20,580 tons, and the remainder went to the United Kingdom. Patiño, the dominant producer, supplied approximately 50 percent of the country total—an increase of 14 percent from 1942. Under a 10-year contract, the Patiño concentrate is shipped to England, but 20,000 tons are to be diverted to the United States in 1944. Production by the Hochschild interests increased 5 percent to 26 percent of the total, with the remainder provided by Aramayo, medium and small producers. The decline in the shares of the last-named group was due in part to exhaustion of some ore bodies, labor shortage, and marked rises in labor and material costs.

The complete dependence of Bolivia on tin mining as a source of revenue was emphasized by the maintenance of production in spite of political unrest. Considerable bitterness followed the Catavi outbreak of December 1942 and was not lessened by the general conclusions of the joint Bolivian-American investigatory commission that labor conditions and wages were substandard. Peñaranda's government was severely criticized by leaders of the Nationalist Revolutionary Movement (MNR) and led to the resignation of his cabinet in September. About December 20, 1943, the government was seized by a military coup d'etat and a new regime headed by Major Villaroel and leaders of the MNR took its place. In view of the former friendliness of some of the junta members with German commercial interests it was generally believed that the new government was strongly tinged with Fascist or Nazi ideologies. This was sharply denied by Major Villaroel, but after study of the situation nearly all the 21 American republics withheld recognition of his government. The revolutionary Argentine Government was the principal exception and accorded recognition on January 3, 1944. A general strike at the tin mines took place April 19, 1944. The miners were requested to return to work by Major Villaroel. On April 28 it was announced that a "vast revolutionary plot" had been put down, ringleaders were arrested, and the country was declared in a state of siege until a national presidential election could be held in July. During May a special United States commission was dispatched to study and report on the situation. Shortly thereafter about 80 Axis supporters or agents were sent to the United States for internment, and late in June, the State Department recognized the de facto government.

The United States agreement to purchase tin at 60 cents per pound f.o.b. Chilean or Peruvian ports expired June 30, 1943. Negotiations for a new base, expected to be about 63½ cents, were interrupted by the change in government but probably will be resumed after the July 1944 elections. Shipments of concentrate were continued throughout this period, with settlements subject to retroactive revision being made upon the former basis.

Patiño and Hochschild have taken steps to increase production by introducing new methods to improve recovery. At Cerro de Potosí, Hochschild will employ a process developed by U. C. Tainton; and at the Centenario property at Catavi, Patiño will use the sink-float process. These installations may not, in the long run, bring about increased output, but they should retard decline through higher recovery.

British Malaya.—Other than reports emanating from Japanese sources, nothing is known of conditions in Malaya. The Japanese have claimed that mechanical excavation was in progress and that smelting had been resumed at Singapore and elsewhere. Exploitation of the vast tin deposits of southeastern Asia by the Japanese, however, now appears improbable because of lack of machinery, transport, and markets. The subserviency of Thailand alone assures it currently of a supply greater than it can consume. With additional tribute wrung from Malaya and the Netherlands Indies tin has lost its economic status. Color is lent to this belief by an announcement from Radio Hilversum, reported in the Mining Journal (London) of September 25, 1943, that the tin price had been reduced from 830 to 430 yen per metric ton. In the early months of 1944 the Japanese position began to deteriorate rapidly. American forces moved westward in the Pacific to the Mariana Islands, and our submarine and aerial attacks made great inroads on their shipping. Meanwhile Allied forces acting in the Indian Ocean raided the Andaman Islands and the western tip of Sumatra and penetrated the Malacca Straits.

Notwithstanding these offensive successes, the ultimate dispossession of the Japanese from Malaysia is likely to take several years, which means that the United Nations may not ease their tin-restriction programs as yet. Somewhat more optimism apparently prevails among Malayan operators. Many of the companies have set up their head offices in London, and the Malayan Chamber of Mines there started preparation of rehabilitation plans. At the same time, in anticipation of the probable Japanese devastation of mines and works, attempts are being made to have the Government bear a heavy share of the reconstruction costs.

Canada.—Electric smelting of the Consolidated Mining & Smelting Co. Sullivan-mine tin concentrates at Kimberly, British Columbia, was continued in 1943 at about the same rate as in 1942. The product of the smelter averages 99.647 percent tin and enters the market as Tadanac brand. The smelting method used has been described by Jones and Thunaes.[7]

The Consolidated Co. made some explorations in the Yellowknife area, about 700 miles north of Edmonton. It was reported that some pegmatite dikes carrying coarse cassiterite had been found.

Rigid tin conservation has been practiced in Canada. Direct and indirect war uses took 60 percent of current consumption. With the Sullivan production and maintenance of restrictions, it was estimated that all needs could be met for 2 years without importation.

China.—The production of tin in China in 1943 has been estimated at 5,000 tons. Exports, which have been greatly reduced since transportation over the Burma Road was disrupted, have been limited to the quantity that could be flown out to India. The United Air Transport Service reported in July 1943 that in 8 weeks 47 tons of tin, 70 tons of tungsten, 70 tons of silk, and 32 tons of pig bristles had been flown from China to India. It was reported that the U. S. S. R. had not agreed to the reopening of the ancient caravan route through Sinkiang to Russian Turkestan.

In the provinces of Kiangsi and Kwangsi tin mining has been severely affected by Japanese army occupation of all important industrial centers early in the war, very high transportation costs, scarcity of labor, and unfavorable exchange rates.

There are two modern smelters in China, one at Kochiu, Yunnan, and one at Papu, Kwangsi. The combined capacity of these plants has been given as great as 14,000 tons of highly refined (99.8 to 99.95 percent tin) metal annually—adequate to treat all tin ore produced in China. The Papu plant, which is the smaller of the two, treats all the ore from Kwangsi, Kiangsi, and Hunan (normally about 3,500 tons of metal). The Japanese bombed this plant, but since then it has been safely housed in a limestone cave.

Germany.—Although Germany is known to have received substantial quantities of tin from Portugal and perhaps from Japan, there is some evidence of a developing near-famine condition. Virtually all tin-bearing materials throughout controlled areas have been confiscated, and complicated metallurgical processes have been employed to recover tin from bell metal, bearing metals, liquation residues, and many low-content materials. Also, in the latter part of 1943 the tin-plate shortage became so acute that all orders for it had to receive a special approval from the Deputy Reich commissioner for Iron and Nonferrous Metals. Canning has been maintained partly by using bonderized black plate, glass, and other substitutes for cans, very few of which have been available for civilian packs. In spite of this apparent scarcity, it was reported late in the year that a few thousand cases of tin plate of Belgian origin had been imported by Portugal for packing sardines.

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[7] Jones, E. L., and Thunaes, H., Electric Furnace Smelting of Tin Concentrate from Sullivan Ore: Canadian Min. and Met. Bull. 382, February 1944, pp. 35-43.

Tin destined for Germany was reported among the cargoes of three blockade runners reported sunk by our Navy in the South Atlantic on February 4, 1944. The British Parliamentary Secretary to the Minister of Economic Warfare also reported that four German cargo ships en route to Europe from the Far East had been sunk during first part of 1944 carrying approximately 10,000 tons of tin. Japan possibly shipped as much as 20,000 tons of tin to Germany in 1943, but it is doubtful if any great part reached its destination, as at least 11 blockade runners have been reported sunk.

Italy.—German propaganda statements have claimed that they were better off by capitulation of Italy, as far as metal supplies are concerned, since they had been supplying Italy from 10,000 to 15,000 tons of copper annually, together with 1,000 to 2,000 tons of tin and 2,000 to 3,000 tons of nickel. The concentrating plant at the Monte Valerio mine, Tuscany, produced about 200 tons of tin annually, and the Canale Serci tin mine in Sardinia has been operating on a small scale.

Japan.—It is doubtful if Japan has continued to work its own low-grade mines in view of the wealth of metal and ore acquired after the occupation of Penang, and subsequently. With the presently demanded increase in war production it appears even less likely now.

It has been surmised that Japan has shipped as much as 10,000 tons of metal to Russia. Sizable quantities were destined for Germany, but many of the blockade runners were intercepted or sunk en route.

Mexico.—Mexico has not been an important source of tin. Production was 426 tons in 1943 compared with 364 in 1942. Total production between 1800 and 1940 has been estimated[8] at 5,315 long tons (73 percent being credited to the final decade of the period). Extremely small placers mined entirely by hand methods, which cannot be worked profitably with machinery, have been the chief source of tin in recent years. Vein mining has been infrequent, and several attempts on a large scale proved unprofitable.

Netherlands East Indies.—No reliable information has been available from the Netherlands East Indies, since their occupation by the Japanese. However, not much tin can have been produced in 1943, as operations probably were confined to scant output of native laborers using primitive methods. According to a Tokio broadcast, tin dredges had been dismantled and scrapped for steel. Preparatory work for rehabilitation of the tin mines after the Japanese have been driven out has been temporarily assigned to a group of Netherlands East Indies Government officials evacuated from the islands before the invasion. It is planned to build completely self-contained, Diesel-driven dredges in the United States and to tow them across the Pacific, as has been done with dredges from Holland. As soon as the Japanese are driven out the dredges would be put to work on off-shore deposits. "Sea tin" formed part of the production of Singkep, and it also exists off the coasts of Banka and Billiton.

Nigeria.—By intensive working of higher-grade and most accessible deposits Nigeria produced 13,680 long tons of tin in 1943 (12,711 in 1942). An abnormally dry season, and to a lesser extent labor shortages, adversely affected production during the latter part of the year. The water shortage handicapped production in two ways: It limited washing in the pits and cut hydroelectric power output so severely that current was rationed. To ameliorate this situation the Nigerian Government has begun construction of a new dam on the Tenti River. The work has been well advanced, so that a substantial water reservoir will become available for use in 1944. If enough water and some additional equipment are available, it is believed that a maximum output of about 14,800 long tons can be attained in 1944.

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[8] Foshag, William F., and Fries, Carl, Jr., Tin Deposits of the Republic of Mexico; Geologic Investigations in the American Republics, 1941–42: Geol. Survey Bull. 935–C, 1942, pp. 99–176.

Proved and probable reserves of tin ore are reported to be sufficient for 7 years at the wartime rate. Important new discoveries are unlikely, although improved operating technique and intensive development work might well extend the life of some of the properties.

Portugal.—Production of tin in Portugal was 3,058 tons in 1943 compared with 2,381 in 1942. Exports of metallic tin were 1,909 tons in 1943 (1,522 in 1942). Shipments to German-controlled European countries amounted to 60 percent of the total in 1943 (48 percent in 1942). Members of the British Parliament were much concerned with this traffic which persisted despite preclusive buying by British and American agencies. In response to questioning, the Secretary to the Ministry of Economic Warfare replied that every effort was being made to impress on the Portuguese Government and the people the importance attached to the matter by the British Government. An Anglo-Portuguese alliance of several hundred years standing prevented the exercise of forceful diplomatic and economic pressure, but some improvement in the situation was noticeable in the spring of 1944.

Under a commercial agreement concluded between Portugal and Spain, Portuguese exports were to include 400 metric tons of tin in 1943. The Portuguese-American Tin Co. has continuously operated its mine without interference other than Portuguese Government orders and restrictions as to sales and prices of tin.

Spain.—Plans of the Peñarroya Co. include the production of metallic tin and its alloys at its carborundum works at Peñarroya—Pueblo Nuevo. It is proposed to treat ores and products containing tin in single-phase arc-type electric furnaces. Calcium stannate obtained as a byproduct of lead smelting will be treated in the electric furnace to obtain bearing metal.

Union of South Africa.—The Zaaiplaats Tin Mining Co., Ltd., milled 41,420 tons of ore and recovered 192.5 long tons of concentrate averaging 71.22 percent tin, during the year ending July 31, 1943. The smelter handled the entire mine output of the Union, Swaziland, and South-West Africa and produced more than 670 long tons of metallic tin. Plant performance and quality of metal were said to be better than in preceding years. The output of the Zaaiplaats and Bulawayo smelters exceeded local needs, and shipments to India were reported.

U. S. S. R.—The Russian tin situation is not definitely known. Presumably it is less critical than in the past 2 years, since direct tinplate exports from the United States declined about 20,000 tons (40 percent) from 1942. In that year 28,000 long tons also were reported shipped to Iran, but the eventual destination was probably the U. S. S. R. In 1943 there was no like movement. These changes also reflect the newly effected Allied control of sea lanes, as well as the possibility that some pig tin may have been obtained from Japan, with which Russia was still on a peace footing in June 1944.

Sketchy reports of tin discoveries have been made again, but no information on locality or extent of the deposits was forthcoming.

United Kingdom.—There has been no disclosure of the quantity of tin stocks in the United Kingdom, but the supply for essential needs has been satisfactorily maintained, with consumption cut to 50 percent. Tin ores from Bolivia and Nigeria (and some metal and ore from Portugal) have been imported in sufficient quantity on reduced smelter requirements. Part of the Bolivian ore scheduled for shipment to the United Kingdom will be diverted to the United States in 1944. Since the beginning of the war very little information has been disclosed regarding production by the Cornwall tin mines, but output is believed to have been around 2,214 tons in 1943. The outlook for tin mining is not good, unless prices are put in line with increased costs (of coal and labor principally) or Government assistance continues. There are four important properties—Geevor, South Crofty, East Pool, and Castle-an-Dinas. The Cornish Tin Mining Advisory Committee has petitioned the British Government for post-war assistance, without which continued existence seems doubtful.

For the greater part of 1943, production of tin plate in Wales fell steadily, reaching the lowest figures in history. However, output increased in the final quarter, and by the end of the year a substantial number of orders were in hand for first quarter of 1944. Manufacturers have agreed to a redundancy scheme whereby at least 30 percent of the old mills will be sterilized. Approval of the scheme by the Board of Trade is awaited. A small quantity of electrolytic tin plate has been produced in a pilot plant but did not find a very ready market. Nevertheless, it has been reported that Richard Thomas & Co., Ltd., which has a continuous cold-strip mill, has ordered an electrolytic tinning unit from the United States. It is expected to reach the production stage in 1944. Bonderized plate has been developed, but its use for food cans has not made much headway.

ARSENIC

By Allan F. Matthews

SUMMARY OUTLINE

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GENERAL STATEMENT

Domestic production of white arsenic increased nearly a tenth in 1943 compared with 1942; and imports, comprising a third of the new supply, were steady.

For the first time in nearly 20 years production of ores mined chiefly for their arsenic content was reported as the United States mine at Gold Hill, Utah, was reopened. The mine has been inactive since 1924–25, but during the last 4 months of 1943 several thousand tons of arsenopyrite ore averaging about 23 percent arsenic (As) were shipped monthly to Midvale, Utah, for recovery of arsenic.

Stocks held by producers and the Government were halved to help meet a record consumption. The quoted price of white arsenic remained at 4 cents a pound throughout 1943. Arsenic was placed under allocation control by the War Production Board May 22, 1942 (Order M–152). Military contract cancellations early in 1944 considerably reduced arsenic requirements, which, together with the expected increase in production at Gold Hill in 1944, should bring supply and requirements more nearly in balance.

Salient statistics for white arsenic in the United States, 1939–43

	1939	1940	1941	1942	1943
Production.....short tons..	22,341	24,983	32,481	28,681	31,202
Imports for consumption.....do....	14,674	9,929	10,292	16,350	16,112
Exports.....do....	[1] 3,178	[1] 1,639	[1] 1,616	[1] 305	1,950
Consumption.....do....	[2] 33,900	[2] 31,600	40,442	42,411	51,083
Value, end of year.....per pound..	$0.03	$0.035	$0.04	$0.04	$0.04

[1] Exports by producers only.

[2] Apparent consumption.

DOMESTIC PRODUCTION

White arsenic production in the United States was 9 percent greater in 1943 than in 1942 but 4 percent less than in 1941. The output, principally a byproduct of copper and lead smelting, although augmented in 1943 by the treatment of rich arsenical ores, was by the American Smelting & Refining Co. at Tacoma, Wash., El Paso, Tex., and Murray, Utah; by the Anaconda Copper Mining Co. at Anaconda, Mont.; and by the United States Smelting, Refining & Mining Co. at Midvale, Utah. Canadian cobalt-nickel concentrates are treated by the Ferro Enamel Corporation, Cleveland, Ohio, in making calcium arsenate and by the Shepherd Chemical Co., Cincinnati, Ohio, in making sodium arsenite.

Government program.—The Metals Reserve Co. in March 1943 appointed the United States Smelting, Refining & Mining Co. its agent for the purchase and treatment of arsenopyrite from the United States mine at Gold Hill, Utah, to yield 47,000 short tons of crude arsenic within 5 years after completion of facilities. Two properties at Gold Hill (the United States mine of the United States Smelting, Refining & Mining Co. and the Western Utah Copper Co. mine) have been important producers of arsenical ores in the past, and ore reserves are estimated to exceed several hundred thousand tons. The two mines are credited with a production of 35,444 tons of ore in 1924 and 3,045 tons in 1925, but no production of arsenical ores has been recorded since 1925 until the United States mine was reopened in September 1943. During the remainder of 1943 the company shipped several thousand tons of ore each month to the enlarged arsenic plant at Midvale. The ore is chiefly arsenopyrite, with minor quantities of scorodite, and in 1943 averaged about 23 percent arsenic (As). The nearby property of Western Utah Copper Co. was not reopened during 1943, although plans were proposed to resume shipments in 1944. During the year, however, several hundred tons of arsenopyrite ore that had been mined in 1924–25 and held in stock at the Murray plant of the American Smelting & Refining Co. were treated at the arsenic roaster unit at that plant, thus augmenting the output of arsenic.

Through arrangements made by the Metals Reserve Co. in June 1943, the American Smelting & Refining Co. planned to produce 10,000 tons of crude arsenic from flue dust supplied by Getchell Mine, Inc.,[1] Red House, Nev., and 1,568 tons from speiss furnished by Richmond Eureka Mining Co., Eureka, Nev. The former project yielded 432 tons and the latter 136 tons by the end of 1943. In June 1943 Jardine Mining Co.,[2] which has not produced arsenic since 1936, contracted with the Metals Reserve Co. to furnish 5,000 tons of refined arsenic in 1944–45 from a new recovery plant. In December 1943 the Ferro Enamel Supply Co. (agent for Metals Reserve Co.), Cleveland, Ohio, contracted to deliver to E. I. du Pont de Nemours & Co., Inc., approximately 4,125 tons of calcium arsenate to be derived from treatment of cobalt-nickel speiss imported from Burma before the Japanese invasion.

White arsenic produced and sold by producers in the United States, 1939–43

Year	Crude			Refined			Total		
	Production (short tons) [1] [2]	Sales		Production (short tons)	Sales		Production (short tons)	Sales	
		Short tons	Value [3]		Short tons	Value [3]		Short tons	Value [3]
1939	17,499	17,070	$343,000	4,842	5,369	$152,500	22,341	22,439	$495,500
1940	18,241	16,688	365,700	6,742	6,651	195,600	24,983	23,339	561,300
1941	26,843	28,661	844,793	5,638	6,123	274,527	32,481	34,784	1,119,320
1942	25,658	27,981	1,198,424	3,023	3,057	161,942	28,681	31,038	1,360,366
1943	26,269	27,588	(4)	4,933	4,835	(4)	31,202	32,423	(4)

[1] Excludes crude consumed in making refined.
[2] Compounds made directly from ores, flue dust, and speiss contained white arsenic as follows: 1942, 290 tons; 1943, 172 tons.
[3] Partly estimated.
[4] Bureau of Mines not at liberty to publish.

FOREIGN TRADE [3]

Imports of white arsenic in 1943 were about the same as in 1942. The duty-free status was bound in the Reciprocal Trade Agreement with Mexico effective January 30, 1943. White arsenic exports, the greatest since 1939, went largely to United Kingdom, Canada, and U. S. S. R.

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[1] Van Voorhis, B. W., Jr., How Getchell Treats Tungsten, Arsenic and Gold Ores in Its Remodeled Mill: Min. World, vol. 5, No. 3, March 1943, pp. 9–13.
[2] Engineering and Mining Journal, Montana: Vol. 145, No. 2, February 1944, p. 135.
[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

White arsenic imported for consumption in the United States, 1939–43,[1] by countries

Country	1939		1940		1941		1942		1943 [1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Belgium	323	$10,098	15	$1,152						
Canada	471	24,760	339	18,016	862	$58,850	1,449	$32,977	35	$2,349
France	2,200	50,224	1,654	25,799						
Germany	(2)	4								
Japan	963	30,079	224	10,307	193	10,668				
Mexico	8,124	377,568	7,520	393,413	9,237	528,488	14,901	859,836	15,974	870,380
Norway			1	187						
Peru									103	3,945
Sweden	2,593	69,304	176	4,156						
	14,674	562,037	9,929	453,030	10,292	598,006	16,350	892,813	16,112	876,674

[1] Figures for 1943 represent arsenic trioxide (As_2O_3) content; not strictly comparable with earlier years.
[2] Less than 1 ton.

Arsenicals imported into and exported from the United States, 1939–43, by classes, in pounds

Class	1939	1940	1941	1942	1943
Imports for consumption:					
White arsenic	29,347,810	19,857,310	20,583,253	32,700,351	[1] 32,224,879
Metallic arsenic	39,197	13,228	2,240	6,854	6,840
Sulfide	656,498	220,445	11,025		
Arsenic acid (H_3AsO_4)	210				
Calcium arsenate	1,627,193	432,785	1,230,960	215	514
Lead arsenate	11,557				
Sheep dip	306,900	341,556	264,350	272,540	545
Paris green and london purple [2]	45,823	25,603	12,000		
Sodium arsenate	7,482				133,247
Exports:					
White arsenic [3]	6,356,933	3,278,558	[4] 3,231,536	610,206	3,950,657
Calcium arsenate	6,731,103	4,879,391	5,897,598	3,941,722	6,384,559
Lead arsenate	1,712,583	2,900,250	9,594,483	592,029	3,054,326
Paris green (cupric acetoarsenite)	(5)	(5)	[6] 224,976	171,464	914,800

[1] Arsenic trioxide (As_2O_3) content; not strictly comparable with earlier years.
[2] According to the U. S. Department of Agriculture there have been no imports of london purple since 1936.
[3] As reported to Bureau of Mines by the producers, 1939–42; 1943: As reported by the U. S. Department of Commerce.
[4] Dealers exported an additional 1,077,244 pounds.
[5] Not separately classified.
[6] Figures cover July to December; not separately classified before July 1.

CONSUMPTION AND USES

Consumption of white arsenic in the United States increased 23 percent in 1943 compared with 1942 and established a new record.

Insects cause an annual loss of about 10 percent of all food and fiber crops, so their control is most significant. Calcium arsenate combats the boll weevil, tomato fruitworm, and other insects, and lead arsenate is effective against insects attacking fruits, flowers, and shrubs.[4] Production of calcium arsenate, 100 percent $Ca_3(AsO_4)_2$, was 34,932 short tons in 1943 compared with 38,898 tons in 1942; and production of lead arsenate (acid and basic) was 36,978 tons in 1943 compared with 31,789 tons in 1942, according to the United

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[4] Howard, N. F., Weigel, C. A., Smith, C. M., and Steiner, L. F., Insecticides and Equipment for Controlling Insects on Fruits and Vegetables: U. S. Dept. of Agriculture Misc. Pub. 526, November 1943, 52 pp.
McBride, R. S., Insecticide Chemicals Needed for War Food Supply: Chem. and Met. Eng., vol. 50, No. 3, March 1943, p. 101.

States Department of Commerce. Insecticidal use of iron arsenate was described.[5]

The glass industry was greatly inconvenienced by its reduced share of arsenic, and it turned to such substitutes as antimony, sodium sulfate, and cerium.[6] Creosote and zinc chloride are the most important wood preservatives, but in addition 654 short tons of Wolman salts (25 percent sodium arsenate) and 120 tons of zinc meta-arsenate were used in 1942, according to the United States Forest Service. Arsenic acid is used in the manufacture of khaki dyes. Sodium arsenite is a poison bait—not recommended, however, for combatting Mormon crickets (grasshoppers).[7] Lead-base alloys containing up to 3 percent As substitute for tin-base babbitt and solder. About 3 to 10 pounds of white arsenic are consumed for each million cubic feet of industrial gas purified by the Thylox method.[8] Manufacturers and distributors of antisyphilitic drugs sold 30 million doses in 1943 compared with 33 million in 1942 and 18 million in 1941, according to the United States Public Health Service. Production of these drugs—neoarsphenamine, acetarsone, carbarsone, tryparsamide, arsenoxides (mapharsen, clorarsen, and phenylarsine), and sulfarsphenamine—totaled 83,026 pounds in 1943 compared with 66,753 pounds in 1942, according to the War Production Board.

White arsenic consumed in the United States, 1941–43, by uses

Use	1941		1942 [1]		1943 [1]	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Insecticides	24,680	61	30,351	73	29,195	57
Weed killer	7,123	18	4,650	11	3,243	6
Glass	4,281	11	1,868	4	200	1
Wood preservative [2]	1,366	3	1,038	3	(3)	(3)
Dyestuffs	417	1	1,080	3	1,004	2
Poison bait	414	1	(3)	(3)	(3)	(3)
Metal and alloys	246	1	(3)	(3)	(3)	(3)
Other [4]	1,915	4	2,533	6	17,441	34
Total consumption	40,442	100	41,520	100	51,083	100

[1] Data from War Production Board; largely based on allocations.
[2] Includes wall board.
[3] Included under "Other."
[4] Gas purification, pharmaceuticals, cattle dip, paint, and other uses.

PRICES

White arsenic continued to be quoted at 4 cents a pound throughout 1943, according to Oil, Paint and Drug Reporter. The Bureau of Mines is not at liberty to publish the average value of producers' shipments. The base price of lead arsenate in carlots was set at 11–11½ cents a pound by the Office of Price Administration February 8, 1943 (Maximum Price Regulation 315). An amendment effective April 6 fixed the base ceiling price of other insecticides as follows (cents per pound in carlots): Calcium arsenate, 7–7½ cents; paris green, 20–25 cents; and london purple, 7–8 cents.

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[5] Ambruster, Howard W., Arsenate of Iron: Jour. Econ. Entomology, vol. 36, No. 5, November 30, 1943, p. 798.

[6] Glass Industry, Decolorization and Fining in the Absence of Arsenic: Vol. 24, No. 3, March 1943, pp. 107–127.

[7] Cowan, F. T., Shipman, H. J., and Wakeland, Claude, Mormon Crickets and Their Control: U. S. Dept. of Agriculture Farmers' Bull. 1928, September 1943, 17 pp.

[8] Howat, D. D., Hydrogen Sulfide Removal, II—Recovery of Sulphur from Commercial Gases: Chem. Age, vol. 49, No. 1257, July 31, 1943, pp. 99–105.

STOCKS

Stocks of white arsenic held by producers declined heavily in 1941–43 to help meet increased consumption.

Year-end stocks of arsenic compounds in the United States, 1939–43, in short tons

Year	White arsenic			Calcium arsenate [1] (producers)	Lead arsenate [2] (producers)
	Producers	Government	Total		
1939	5,505	----------	5,505	(3)	(3)
1940	6,944	----------	6,944	(3)	(3)
1941	4,518	----------	4,518	1,786	5,108
1942	2,187	2,693	4,880	2,584	2,223
1943	1,138	1,018	2,156	4,757	4,020

[1] Basis, 100 percent $Ca_3(AsO_4)_2$. From U. S. Department of Commerce.
[2] Acid and basic. From U. S. Department of Commerce.
[3] Comparable data not available. Suppliers held 12,500 tons of calcium arsenate and 5,000 tons of lead arsenate at end of 1940 compared with 2,650 and 5,625 tons, respectively, at end of 1941, according to the Agricultural Insecticide and Fungicide Association.

WORLD ASPECTS

World production of white arsenic in recent years, insofar as data are available, is shown in the accompanying table.

World production of white arsenic, 1936–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1936	1937	1938	1939	1940	1941	1942	1943
Australia:								
New South Wales	124	-------	-------	(2)	(2)	(2)	[3] 2,640	(2)
Western Australia	3,526	2,087	4,063	1,439	3,385	(2)		
Belgium-Luxemburg (exports)	2,731	3,039	2,706	3,332	(2)	(2)	(2)	(2)
Brazil	732	717	519	713	1,088	1,172	900	[4] 477
Canada	619	630	987	790	950	1,605	4,273	1,362
China	(2)	(2)	(2)	(2)	800	(2)	(2)	(2)
Chosen	230	-------	(2)	(2)	(2)	(2)	(2)	(2)
France	9,750	6,501	(2)	(2)	(2)	(2)	(2)	(2)
Germany (exports)	2,739	2,852	2,845	(2)	(2)	(2)	(2)	(2)
Greece	85	234	77	113	(2)	(2)	(2)	(2)
Hungary	-------	100	(2)	(2)	(2)	(2)	(2)	(2)
Italy	-------	-------	810	(2)	(2)	1,200	(2)	(2)
Japan	2,629	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Mexico	8,527	10,762	8,894	7,063	9,268	12,844	18,520	20,301
Peru	-------	-------	-------	-------	-------	-------	-------	1,196
Portugal	150	112	1	426	410	535	(2)	(2)
Rumania	-------	6	3	(2)	(2)	(2)	(2)	(2)
Southern Rhodesia	-------	-------	19	-------	(2)	(2)	[5] 17	(2)
Spain	-------	-------	(2)	(2)	14	94	(2)	(2)
Sweden (sales) [6]	8,647	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	155	97	66	(2)	(2)	(2)	(2)	(2)
United States	13,952	15,253	15,136	20,267	22,664	29,466	26,019	28,306
	55,700	56,000	59,000	63,000	71,000	(2)	(2)	(2)

[1] Arsenic is also believed to be produced in Czechoslovakia, Iran, Turkey, and U. S. S. R. Production figures are not available for these countries.
[2] Data not available; in 1936 to 1940, inclusive, estimate included in total.
[3] Estimate.
[4] January to June, inclusive.
[5] August to December, inclusive.
[6] Arsenic content of ores mined was as follows—1936: 23,312 tons; 1937: 20,954 tons; 1938: 21,480 tons; data not available for later years.

Brazil.—Of 477 metric tons of white arsenic output in the first half of 1943, St. John d'el Rey Mining Co. produced 386 tons; Cia. Minas da Passagem, 83 tons; and Cia. Brasileria de Mineracao S/A, 8 tons. Sales quotas and prices of white arsenic required authorization of the Chemical and Pharmaceutical Products Control after late 1943.

Canada.—Refined arsenic was produced by Deloro Smelting & Refining Co., Ltd., Deloro, Ontario, and Beattie Gold Mines, Ltd., Duparquet, Quebec, in 1943. Crude arsenic from the Beattie mine and O'Brien Gold Mines, Ltd., Cadillac Township, Quebec, was treated at Deloro. The main pillar in the glory hole of the Beattie mine collapsed June 16, 1943; consequently the mill was inoperative until December. During the shut-down period a plant for refining crude arsenic was installed.[9] Arsenical gold concentrates are shipped from British Columbia mines to the Tacoma (Wash.) smelter of the American Smelting & Refining Co. The contract of Wampum Gold Mines, Ltd., with the Metals Reserve Co., United States Government agency, lapsed.

Chile.—Native arsenic ore containing about 75 percent As and 60 ounces of silver per metric ton was offered for shipment.

Kenya.—Enough arsenical pyrite reserves have been proved by Messrs. Macalder Mines, Ltd., South Kavirondo, to supply the Colony cattle-dip and locust-poison requirements.[10]

Mexico.—White arsenic is produced by the American Smelting & Refining Co., San Luis Potosí, and by the American Metal Co., Ltd., Torreón.

Peru.—The Cerro de Pasco Copper Corporation began production of crude arsenic in June 1943, but there was little output in the third quarter because of difficulty in obtaining satisfactory containers. Steady production got under way in the fourth quarter, but by the end of the year only 93 metric tons had been delivered to Metals Reserve Co., the United States Government agency, on a contract calling for 800 tons monthly in 1943–44. Construction of a plant near Lima to produce copper arsenate for antimalarial use was begun in 1943.

Portugal.—British-owned companies exported 135 metric tons of refined arsenic from the Pintor mine and 30 tons of crude arsenic from the Panasqueira mine to United Kingdom in 1942.[11]

Southern Rhodesia.—Refined arsenic is produced at the Champion mine, Gwanda, and from Que Que Customs Roasting plant gold-bearing residues at Rodia Siding, Salisbury.[12] Arsenic has been excluded from excess profits tax to assist expansion.

Spain.—Several manufacturers of arsenicals plan to expand output.[13]

Sweden.—Arsenic is recovered from Boliden ores in such quantities as to make Sweden the world's largest producer. White arsenic now stored in concrete silos in that country is believed to exceed 300,000 tons.

Union of South Africa.—Shortage of arsenic for sheep and cattle dips has led to consideration of pyridines and other coal-tar compounds as a substitute.[14]

United Kingdom.—A plan for official approval of proprietary insecticides was placed in effect October 1942.[15] The price of refined white arsenic in 20-ton lots was raised from £40 to £59 per long ton in October 1943, according to Metal Bulletin. Arsenic metal continued to be quoted at £375 per ton.

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[9] Northern Miner, Beattie to Resume in December: Vol. 29, No. 35, November 18, 1943, p. 10.

[10] Mining Journal (London), Developing Kenya's Minerals: Vol. 220, No. 5620, May 8, 1943, p. 226.

[11] Mining Journal (London), vol. 221, No. 5649, November 27, 1943, p. 586.

[12] Milton, H. C., Southern Rhodesian Arsenic—an Outline of Its Occurrence, Development, and Production: South African Min. and Eng. Jour., vol. 54, part 1, No. 2632, July 10, 1943, pp. 409, 417.
South African Mining and Engineering Journal, Supplies of Arsenic in Southern Africa: Vol. 54, part 2, No. 2645, October 9, 1943, p. 120.

[13] Swift, A. H., Spain's Chemical Industry Expands: For. Commerce Weekly, vol. 11, No. 9, May 29, 1943, pp. 10–11, 38–39.

[14] South African Mining and Engineering Journal, Substitute for Arsenic—Cattle Dips from S. A. Coal Tar: Vol. 54, part 2, No. 2643, September 25, 1943, p. 77.

[15] Chemical Age (London), vol. 48, No. 1247, May 22, 1943, p. 585.

BISMUTH

By ALLAN F. MATTHEWS

SUMMARY OUTLINE

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GENERAL STATEMENT

Bismuth production in the United States in 1943 was little more than half that in 1942, but large imports and restricted consumption balanced supply and demand so as to obviate inventory withdrawals. Allocation control was instituted by the War Production Board over metallic bismuth February 1, 1943 (Order M-276), and over bismuth chemicals April 1, 1943 (Order M-295).

PRODUCTION

Bismuth metal production in the United States receded 44 percent in 1943 from the record high of 1942. The output, however, compared favorably with pre-war levels. Larger production in 1940-42 resulted in part from the cleaning up of residues accumulated over a period of years. The Bureau of Mines is not at liberty to publish data showing the domestic production of bismuth.

Three primary producers recover byproduct bismuth principally from domestic and imported lead and copper ores and from Mexican bismuth-lead bullion bars. The American Smelting & Refining Co. produces bismuth-lead alloys at its Selby (Calif.), Perth Amboy (N. J.), and Monterrey (Mexico) plants for refinement at Omaha, Nebr. From Montana copper and Utah lead ores the Anaconda Copper Mining Co., at Tooele, Utah, produces bismuth-lead bullion, which is refined by its subsidiary, International Smelting & Refining Co., East Chicago, Ind. The United States Smelting, Refining & Mining Co. ships bismuth-lead bullion from Midvale, Utah, for refinement at East Chicago, Ind., by its subsidiary, U. S. S. Lead Refinery, Inc. The principal importer and consumer is the Cerro de Pasco Copper Corporation, New York, which refines large quantities of bismuth in Peru.

FOREIGN TRADE[1]

Imports.—Bismuth ore imports in 1943 comprised 68,600 pounds (36.3 percent Bi) from Bolivia, 34,200 pounds (46.8 percent Bi) from Argentina, 29,800 pounds (12 percent Bi) from Mexico, and 6,000 pounds (72 percent Bi) from Brazil, according to the Foreign Economic Administration. The entire Mexican bismuth output (see world table at end of this chapter) is imported in the form of bismuth-lead bars (plus a small quantity of ore) for refining in the United States. All entries of refined metallic bismuth in 1939–43 were from Peru. There were no "imports for consumption" of the metal in 1942, and "general imports" of 222,684 pounds were reexported.

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[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Bismuth imported for consumption in the United States, 1939–43

Year	Bismuth ore [1]			Refined metallic bismuth		Bismuth compounds and mixtures	
	Pounds		Value	Pounds	Value	Pounds	Value
	Gross weight	Bi content					
1939	(1)	(1)	(1)	182,832	$154,339	297	$649
1940	(1)	(1)	(1)	123,880	118,260	4	31
1941	(1)	(1)	(1)	223,477	223,463	41	744
1942	(1)	(1)	(1)	----------	----------	7	22
1943	138,600	48,800	$52,400	[2] 430,874	[2] 397,676	13	53

[1] Figures from Foreign Economic Administration. Those for 1939–42 are not available but are believed to be negligible.

[2] An additional 71,236 pounds (valued at $43,498) reported by the United States Department of Commerce as "bismuth" is ore and is covered by that category in this table.

Exports.—Exports of bismuth metal were 929 pounds in 1943 compared with 1,192 pounds in 1942 and went principally to Mexico and Argentina. Exports of bismuth alloys were 15,280 pounds in 1943 compared with 13,635 pounds in 1942; all were shipped to Canada.

Bismuth exported from the United States, 1941–43, by classes

Class	1941 (September-December) [1]		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value
Matte	[1] 4,708	[1] $3,250	11,495	$6,387	10	$20
Metal and alloys	[1] 433,652	[1] 441,721	14,827	10,254	16,209	10,745
Compounds and mixtures:						
Carbonate	20,732	34,143	70,356	91,674	23,546	38,395
Chloride	111	356	317	832	2,437	6,962
Gallate	11,269	17,772	19,012	28,748	6,647	10,553
Iodide	82,990	126,667	1,002	1,965	551	1,484
Nitrate	31,818	41,633	146,769	98,812	30,080	41,113
Oxide	163	677	450	1,701	245	856
Saccharate	25	35	2	4	----------	----------
Sulfate	----------	----------	30	45	----------	----------
Other	4,854	8,897	25,129	36,651	5,936	12,510

[1] Figures for matte and for metal and alloys in 1941 cover July to December, inclusive. Earlier data are not available.

CONSUMPTION AND USES

Bismuth consumption in the United States was approximately 2,000,000 pounds in 1943 compared with an apparent consumption of 2,500,000 pounds in 1942, some 1,000,000 to 1,400,000 pounds annually in 1936–41, and 300,000 pounds annually during World War I.

Pharmaceuticals contained 49 percent of the bismuth consumed in 1943 compared with 85 to 90 percent in 1939. Such compounds are manufactured in about the same quantities as formerly, but the increased consumption of bismuth has been predominantly in metallurgical applications. Bismuth pharmaceuticals are used primarily in indigestion remedies but also in antisyphilitic drugs and cosmetic powder. As a conservation measure, the consumption in cosmetics was reduced in 1943. The use of thiobismol (sodium bismuth thioglycolate) with quinine has been recommended for malaria treatment.[2]

Bismuth alloys melt at low temperatures, and their volume expands or remains constant upon solidification from melts. These properties make alloys of bismuth (43–55 percent Bi) with lead, tin, and cadmium useful for pattern metal, assembly and checking fixtures, die and punch mounts, and filler for bending thin-walled tubing, particularly in the aircraft industry. Most of the tube bending, however, is now accomplished on machines by methods not utilizing bismuth filler. Bismuth solder (14 percent or more Bi) is an alternative of crimping for armor-piercing shells. Other bismuth solders[3] were used as a substitute for tin solders until tin became less critical than bismuth. Low-melting bismuth alloys serve as fuses in fire detectors, sprinklers, and gas containers and as coatings for selenium rectifiers.

Bismuth consumed in the United States, 1941–43, by uses

Use	1941 [1] (percent of total)	1942 [1] (percent of total)	1943 [2]	
			Pounds	Percent of total
Pharmaceuticals: Medicines and cosmetics	60	45	985,544	49
Pattern metal, mounts, and tube bending	15	15	652,558	33
Solders and bearings	10	31	[3] 237,212	12
Miscellaneous	15	9	[4] 129,077	6
Total consumption	100	100	2,004,391	100

[1] Estimated from producers' and importers' shipments.
[2] From War Production Board.
[3] Includes 208,632 pounds in ammunition solders; most of remainder in tin-saving solders.
[4] Includes 40,889 pounds in fuse alloys and 31,912 pounds in rectifier coatings.

STOCKS

Producers, distributors, and consumers reduced their bismuth stocks 70 percent in 1943, largely as a result of shipments to the Government stock pile. Striving toward the objective set in July 1943 of a 590,000-pound increment for the year, the Government-owned Metals Reserve Co. between January 1 and December 31, 1943, increased its stock pile of metallic bismuth from 352,701 to 832,697 pounds—all refined in the United States but including 529,922 pounds imported from Mexico in bismuth-lead bullion. During 1943 the Metals Reserve Co. also acquired 129,192 pounds of foreign bismuth ore, of which 28,592 pounds were resold before the year's close.

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[2] Young, Martin D., McLendon, Sol B., and Smarr, Roy G., The Selective Action of Thiobismol on Induced Malaria: Jour. Am. Med. Assoc., vol. 122, No. 8, June 19, 1943, pp. 492–494.

[3] Phillips, Albert J., Bismuth Solders: Metal Ind. (London), vol. 62, No. 10, March 5, 1943, pp. 150–151.

PRICES

Metallic bismuth continued to be quoted throughout 1943 at $1.25 per pound, ton lots, according to E&MJ Metal and Mineral Markets. Base prices of bismuth compounds, likewise unchanged, were listed by Oil, Paint and Drug Reporter as follows, per pound:

Chloride	$2.85	Oxychloride	$3.10	Subnitrate	$1.20
Citrate	2.75	Subbenzoate	3.40	Subsalicylate	2.50
Citrate, ammonia	3.40	Subcarbonate	1.50	Sulfocarbolate	3.65
Hydroxide	3.35	Subgallate	1.40	Trioxide	3.65
Nitrate	1.30	Subiodide	4.13		

WORLD ASPECTS

World production of bismuth approximated 1,400,000 kilograms (3,000,000 pounds) in 1943. The principal producers were the United States, Peru, Canada, and Mexico.

World production of bismuth, 1938–43, by countries, in kilograms[1]

[Compiled by B. B. Waldbauer]

Country[1]	1938	1939	1940	1941	1942	1943
Argentina		[2] 2,860	4,880	10,040	(3)	[4] 20,900
Australia (in ore)[5]	4,600	2,200	2,800	2,200	4,800	6,800
Bolivia (in ore and bullion exported)[6]	17,194	12,653	18,700	22,604	8,896	12,419
Canada: Metal		185,722	18,479	6	156,605	180,347
In bullion	4,316		8,069	3,401	1,043	
Mexico (in impure bars)	185,797	163.683	185,433	97,971	128,041	175,055
Norway (in ore)	470	(3)	(3)	(3)	(3)	(3)
Peru: Metal	201,961	402,027	387,479	276,907	373,942	482,916
In lead-bismuth alloy	13,178	52,430	56,314	178,138	16,913	
Spain (in ore)			41,830	(3)	(3)	(3)
Union of South Africa (in ore)	2,636	1,379	(3)	(3)	[7] 3,000	(3)
United States	(8)	(8)	(8)	(8)	(8)	(8)
World production (estimate)	1,000,000	1,300,000	1,400,000	1,400,000	1,700,000	1,400,000

[1] Bismuth is believed to be produced also in Brazil, Burma, China, France, Germany, Japan, Rumania, Sweden, Uganda, U. S. S. R., United Kingdom, and Yugoslavia. Production figures are not available for these countries, but estimates by author are included in total.

[2] In ore.

[3] Data not available. Estimate included in total.

[4] Content of ore exported to United States.

[5] Partly estimated. Excludes content of some bismuth-tungsten concentrates.

[6] Excludes bismuth content of tin concentrates exported.

[7] Estimated.

[8] Production included in total; Bureau of Mines not at liberty to publish figure.

Bolivia.—A surtax of 15 to 25 percent on bismuth exports was decreed May 6, 1942. Campagnie Aramayo de Mines en Bolivio and Fabulosa Consolidated Co. are the principal producers of bismuth ore in Bolivia, although a number of small operators are selling to Banco Minero de Bolivio. It would be possible for these companies plus Patino Mines & Enterprises Consolidated, Inc., to mine ore containing 275,000 kilograms (600,000 pounds) of bismuth annually for a few years, according to the United States Foreign Economic Administration.

Mexico.—Bismuth-lead bars and a little bismuth ore are shipped to the United States for refining. The ore exported in 1943 was from the Rey de Bismuto property, northeast of Culiacán, Sinaloa.

Peru.—According to the United States Foreign Economic Administration, four-fifths of Peruvian bismuth is from lead mines, principally the Colquijirca lead-silver mine, and one-fifth is from the San Gregorio silver-bismuth mine, which is expected to be exhausted in about a year. The ores are smelted at Oroya by the Cerro de Pasco Copper Corporation. Exports of refined bismuth in 1943 were 483 metric tons—258 to England and 225 to the United States; the latter includes 30 tons sunk by submarine attack in the Caribbean Sea in November.

MAGNESIUM

By John H. Weitz and M. E. Trought

SUMMARY OUTLINE

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SUMMARY

Production of primary magnesium in the United States in 1943—nearly four times that in 1942—exceeded demands of the war program and was so great that early in 1944 nearly 40 percent of total installed capacity was shut down. For the second straight year production exceeded the combined output in this country since the inception of the industry in 1915.

Salient statistics of the magnesium industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Production of primary magnesium......short tons..	3,350	6,261	16,295	48,963	183,584
Quoted price per pound [1]..........cents..	27.0	27.0	22.5	22.5	20.5
Exports..........short tons..	2,100	859	[2] 1,549	[2] 4,045	35,631
World production (estimated)..........do....	34,100	49,500	85,500	154,500	296,600

[1] Lowest nominal price (New York) for primary metal ingot 99.8 percent pure, carlots.

[2] Magnesium metal in primary form.

Companies using electrolytic processes for producing magnesium supplied over 85 percent of total output and ferrosilicon and carbothermic processes the remaining 15 percent. Four new plants were put in operation during the year—including Dow Magnesium Co. at Marysville, Mich., Amco Magnesium Co. at Wingdale, N. Y., Electro Metallurgical Co. at Spokane, Wash., and Mathieson Alkali Works at Lake Charles, La.—and all primary metal plants were virtually completed during the year.

Primary magnesium shipped or used (sales) in 1943 totaled 170,267 tons compared with 47,420 tons in 1942. Apparent consumption totaled 155,547 tons (43,375 tons in 1942). By mid-1943 magnesium had been taken off the critical list by War Production Board, and by the end of the year stocks had been built up and supply considerably exceeded demand.

World magnesium output reached a new high mark in 1943, and estimates based upon incomplete statistical data indicate that United States far outstripped the rest of the world. Axis and Axis-dominated countries produced only about 28 percent of the total output, whereas the United Nations furnished 72 percent. Probabilities are that world production will not increase greatly in 1944.

PRODUCTION

Primary magnesium.—Domestic production of primary magnesium in 1943 totaled 183,584 short tons, a 275-percent increase over the 1942 output of 48,963 tons. Primary magnesium shipped or used (sales) totaled 170,267 tons, or 259 percent more than in 1942 (47,420 tons). Basic Magnesium, Inc., at Las Vegas, Nev., Dow Chemical Co. at Midland, Mich., and Freeport, Tex., Dow Magnesium Corporation at Velasco, Tex., and Marysville, Mich., Diamond Magnesium Co., at Painesville, Ohio, and International Minerals & Chemical Corporation at Austin, Tex., produced the bulk of the domestic output of primary metal in 1943—about 85 percent—and the remaining 15 percent was divided among Amco Magnesium Corporation, Wingdale, N. Y., Electro Metallurgical Corporation, Spokane, Wash., Ford Motor Co., Dearborn, Mich., Magnesium Reduction Co., Luckey, Ohio, Mathieson Alkali Works, Inc., Lake Charles, La., New England Lime Co., Canaan, Conn., and Permanente Metals Corporation at Manteca and Permanente, Calif.

Construction on all primary-magnesium-producing facilities was virtually completed during 1943, and all plants operated during the year. Metal was first produced at the Amco Magnesium Co. ferrosilicon-process plant at Wingdale, N Y., during March. Dow Magnesium Corporation poured the first metal at its gigantic 72,000,000-pound Marysville (Mich.) plant in April, and the Ludington magnesium chloride feed plant was in operation a few months thereafter. In May, first production was obtained from the ferrosilicon-process plant of Electro Metallurgical Corporation at Spokane, Wash. On June 7 the last primary magnesium plant to come into commercial production—the Mathieson Alkali Works, Inc., plant at Lake Charles, La.—began to produce metal from magnesium chloride in electrolytic cells of its own design.

The annual rate of production rose from about 125,000 tons in January 1943 to 182,000 tons in June and to 236,000 tons in December. This rapid climb in the rate of output during 1943 culminated in January 1944, when metal was produced at a record rate of 246,000 tons a year. From January to April 1944 the production rate declined steadily, to about 216,000 tons annually; cut-backs effected in the first half of 1944 assure that the decline will continue at least through August, when it is believed the annual production will have declined to approximately 180,000 tons a year. Thus it is likely that the high point of magnesium production has arrived and passed and that an output rate comparable to that in January (about 84 percent of rated total annual capacity) may not again be reached for at least a decade.

As early as mid-1943 it began to be apparent that there would be a surplus of magnesium over and above essential military requirements. Accordingly, the Dow plants, which had been producing considerably in excess of capacity, were curtailed slightly on a voluntary basis. However, not until March 1, 1944, were any substantial cut-backs effected at other plants. Between March 1 and June 1 the following plants had been ordered to cease production: Amco Magnesium Co. (ferrosilicon process); Ford Motor Co. (ferrosilicon process); Mathieson Alkali Works, Inc. (modified electrolytic process); and Permanente Metals Corporation (Manteca, ferrosilicon process). The following were curtailed: Basic Magnesium, Inc. (Magnesium Elektron electrolytic process), cut to 60 percent; Dow Magnesium Corporation (Marysville, Dow process), cut to 60 percent; Electro Metallurgical Corporation (ferrosilicon process), cut to 50 percent; and Dow Chemical Co. (Midland, Dow process), voluntarily cut to about 55 percent of rated capacity. Total shut-downs and curtailments through June 1 represented approximately 39 percent of total rated capacity. By types of process, cut-backs in rated capacity were approximately as follows: Ferrosilicon, 68 percent; electrolytic (excluding Basic Magnesium), 29 percent; M. E. L., 40 percent; carbothermic, no cut.

Three wildcat strikes during 1943 interrupted production of aviation engine parts at the Cleveland (Ohio) plant of American Magnesium Corporation. The strikers, affiliated with the United Mine, Mill and Smelter Workers, C. I. O., walked out on June 23 to try to force rotation of shifts, again on July 20 over bonuses, and the third time late in November against a system of visitor's passes. As the result of a union election, the Mine, Mill and Smelter Workers, C. I. O., ousted the incumbent A. F. L. organization at the Las Vegas plant of Basic Magnesium, Inc., by a close vote.

On March 13, 1944, the Senate Special Committee to Investigate the National Defense Program (Harry S. Truman, chairman) released its report on the magnesium situation in the United States.[1] This report summarizes the history of the magnesium industry in the country both before and during the war. Discussion of various processes, used and not used, and a detailed record of the "bungling and incompetence displayed in the promotion and construction of Basic Magnesium plant at Las Vegas, Nev.," take up much of the space in the report. The report recommended the removal of restrictions on magnesium in view of the large excess of producing capacity. The Committee also recommended that attention be given to new methods of fabrication and new civilian uses, to the end that magnesium will have a better chance to survive as a major industry in the post-war world.

Old and new companies that expanded or began to fabricate magnesium in 1943 through the Defense Plant Corporation included American Radiator & Standard Sanitary Corporation, Litchfield, Ill.—3,600,000 pounds of sand castings annually; Aluminum Co. of America, Garwood, N. J.—900,000 pounds annual expansion to die-casting works; Central Foundry, Inc., Anniston, Ala.—2,400,000 pounds of sand castings annually; Doehler Die Casting Co., Chicago, Ill.—1,000,000 pounds of die castings annually; The Hoover Co., North Canton, Ohio—500,000 pounds of die castings annually; Metal Mold Magnesium Corporation, Cedarburg, Wis.—600,000 pounds of die castings annually; Precision Castings Co., Syracuse, N. Y.—1,200,000 pounds of die castings annually; and Ruppert Die Casting Co., Kansas City, Mo.—300,000 pounds of die castings annually.

Secondary magnesium.—Recovery of secondary magnesium totaled 11,404 short tons (including secondary magnesium incorporated in primary magnesium ingot) in 1943 (6,238 tons in 1942) and required the consumption of 13,909 tons of magnesium scrap, which was almost entirely new scrap. Of the quantity of magnesium recovered, 11,009 tons were as ingot, and 327 tons went into castings, 34 into aluminum alloys, 1 into zinc alloys, and 33 into chemical reagents and metallurgical processes. Additional information on secondary magnesium will be found in the chapter on Secondary Metals—Nonferrous.

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[1] Magnesium: Investigation of the National Defense Program, 78th Cong., 2d sess., Rept. 10, pt. 17, March 13, 1944.

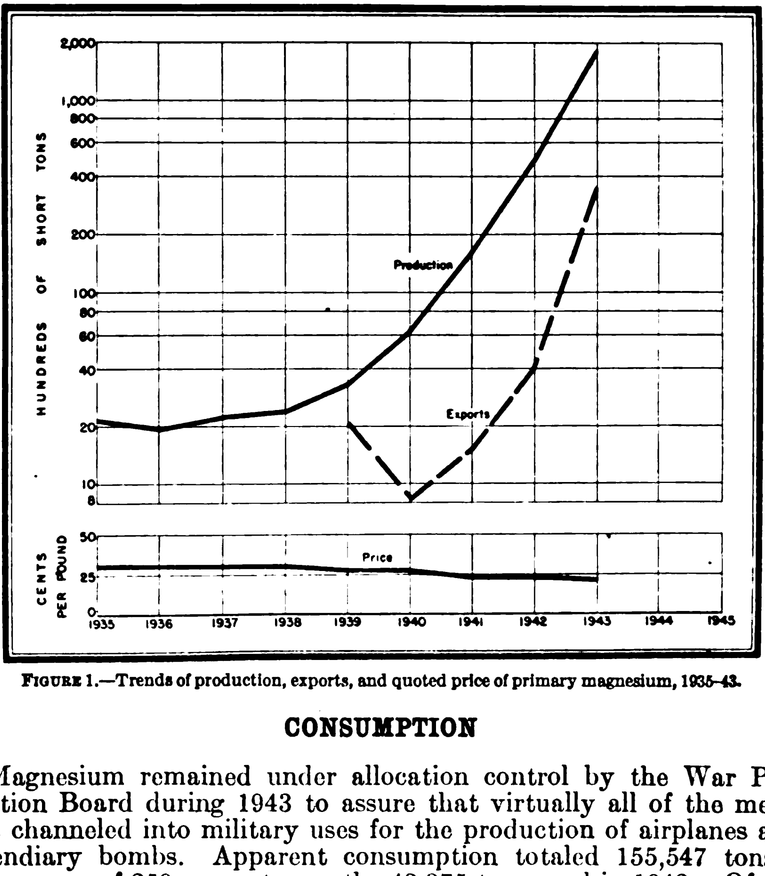

FIGURE 1.—Trends of production, exports, and quoted price of primary magnesium, 1935–43.

CONSUMPTION

Magnesium remained under allocation control by the War Production Board during 1943 to assure that virtually all of the metal was channeled into military uses for the production of airplanes and incendiary bombs. Apparent consumption totaled 155,547 tons—an increase of 259 percent over the 43,375 tons used in 1942. Of the primary magnesium shipped or used in 1943 (170,267 tons), approximately 64 percent was used in the manufacture of magnesium-base alloy structural products; 8 percent in other alloys, chiefly aluminum; 7 percent in powder; and 21 percent for export account (includes 20,911 tons of magnesium-base alloy).

No survey on the consumption of primary and secondary magnesium was conducted by the Bureau of Mines during 1943, and for this reason no data on actual consumption are available.

Production, sales, exports, and apparent consumption of primary magnesium in the United States, 1939–43, in short tons

Year	Production	Sales	Exports	Apparent consumption [1]
1939	3,350	5,325	2,100	3,225
1940	6,261	6,411	[2] 834	5,577
1941	16,295	15,528	1,549	13,979
1942	48,963	47,420	4,045	43,375
1943	183,584	170,267	[3] 14,720	155,547

[1] Does not consider fluctuations in consumers' stocks and metal derived from scrap. Withdrawals from producers' stocks totaled 1,975 tons in 1939; 150 tons in 1940; additions to producers' stocks totaled 767 tons in 1941; 1,543 tons in 1942; and 13,317 tons in 1943.

[2] Of the 859 tons of metal exported, 25 tons consisted of magnesium alloy.

[3] Of the 35,631 tons of metal exported, 20,911 tons consisted of magnesium alloy.

Magnesium products (other than ingot) manufactured in the United States and sold or used by the companies manufacturing the products, 1941–43

Product	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value [1]
Structural products:						
Castings:						
Sand	5,972	$24,669,146	16,012	$71,176,648	29,561	$124,748,000
Permanent mold			5,400	9,015,586	35,910	82,593,000
Die	384	1,155,048	673	2,518,697	1,432	5,613,000
Sheet	216	309,749	438	684,122	840	1,226,000
Structural shapes, rods, tubing (extrusions)	226	313,638	238	342,970	516	916,000
Forgings	13	79,605	22	87,247	113	420,000
Other structural	27	84,718	5	18,958	----------	----------
Total structural products	6,838	26,611,904	22,788	83,844,228	68,372	215,516,000
Nonstructural products:						
Stick	204	121,105	2,209	1,310,281	(2)	(2)
Powder	491	1,305,418	3,208	5,956,132	10,705	16,057,000
Shavings, wire, ribbon, and sawdust	26	37,163	48	38,013	(2)	(2)
Total nonstructural products	721	1,463,686	5,465	7,304,426	(2)	(2)
Grand total	7,559	28,075,590	28,253	91,148,654	(2)	(2)

[1] Estimated.

[2] Not available.

Magnesium-base-alloy structural products manufactured and sold or used in the United States increased 200 percent over 1942. The manufacture of powder sold or used increased 234 percent. Of the structural products sold or used, sand castings comprised 43 percent, permanent mold castings 53 percent, die castings 2 percent, sheet 1 percent, and other structural products 1 percent. The estimated average value of sand castings manufactured in 1943 was $2.11 a pound, permanent mold castings $1.15, die castings $1.96, and all castings $1.59 a pound (compared with $1.87 in 1942).

Of the magnesium-alloy structural products sold or used the aircraft industry took 50 percent, incendiary bomb casings 50 percent, and other industries less than 1 percent. Of that going into the aircraft industry, 64 percent was for the manufacture of engines (including propellers), 23 percent for wheels, 7 percent for frames, and 6 percent for accessories. Sand, die, and permanent mold castings comprised 96 percent of all magnesium-alloy structural products sold for or used in aircraft.

Consumption of magnesium-base-alloy structural products in 1941–43, by uses, in short tons

	1941	1942	1943
Aircraft:			
Engine	3,972	[1] 11,815	21,903
Frame	679	1,319	2,546
Wheel	1,439	4,162	7,698
Accessories	443	648	1,885
Incendiary bomb casings	8	4,735	33,988
Other industries	297	109	352
Total	6,838	22,788	68,372

[1] Includes some alloy used in the manufacture of aircraft frame, wheel, and accessories.

Fabricators of magnesium structural products increased from 59 in 1942 to about 85 in 1943 and of powder from 19 to 20. By the end of 1943, more than 37 companies were producing sand castings, 13 permanent mold castings, 14 die castings, 3 extruded products, 3 forgings, and 16 powder. The largest producers of alloy structural products were:

Acme Metal Products, Los Angeles, Calif.
American Magnesium Corporation, Cleveland, Ohio.
American Radiator & Standard Sanitary Corporation, Louisville, Ky.
Armstrong Cork Co., Lancaster, Pa.
Austin Bridge Co., Dallas, Tex.
Bohn Aluminum & Brass Corporation, Detroit, Mich.
Chevrolet Grey Iron Foundry, Saginaw, Mich.
Dalmo Victor Co., San Francisco, Calif.
Dodge Chicago Plant of Chrysler Corporation, Chicago, Ill.
Doehler Die Casting Co., New York, N. Y.
Dow Chemical Co., Midland, Mich.
Eclipse Aviation Corporation, Bendix, N. J.
Ferro Enameling Co., Oakland, Calif.
Ford Motor Co., Dearborn, Mich.
Hills-McCanna Co., Chicago, Ill.
Howard Foundry Co., Chicago, Ill.
International Silver Co., Meriden, Conn.
Magnesium Products, Inc., Los Angeles, Calif.
Marshall Stove Co., Lewisburg, Tenn.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Michigan Light Alloys Corporation, Grand Rapids, Mich.
Metal-Mold Magnesium Corporation, Cedarburg, Wis.
Monarch Aluminum Manufacturing Co., Cleveland, Ohio.
Stewart Die Casting Co., Chicago, Ill.
Vitreous Steel Products Co., Nappanee, Ind.
Wellman Bronze & Aluminum Foundry, Cleveland, Ohio.
Wright Aeronautical Corporation, Paterson, N. J.

Producers of powder included:

American Magnesium Corporation, Cleveland, Ohio.
California Fuel & Utilities, Inc., San Francisco, Calif.
Ferro Enamel Corporation, Cleveland, Ohio.
Imperial Paper & Color Corporation, Glens Falls, N. Y.
Magna Manufacturing Co., New York, N. Y.
Metals Disintegrating Co., Elizabeth, N. J.
National Fireworks, Inc., West Hanover, Mass.
National Magnesium Co., Elkton, Md.
New England Magnesium Co., Malden, Mass.
Pacific Coast Chemical Co., Aberdeen, Wash.
Pilgrim Ordnance Works, West Hanover, Mass.
Pulverizing Machinery Co., Roselle Park, N. J.
Reade Manufacturing Co., Inc., Lakehurst, N. J.

United States Magnesium Corporation, Pleasant Valley, N. Y.
United Wallpaper Factories, Inc., Chicago, Ill.
Universal Match Corporation, St. Louis, Mo.

PRICES

At the request of the Office of Price Administration, Dow Chemical Co. reduced its base price of standard four-notch magnesium ingot from 22.5 to 20.5 cents a pound on January 1, 1943. Effective February 1 the Office of Price Administration, in Maximum Price Regulation 314, established 20.5 cents a pound as the maximum price per pound for standard four-notch ingot, except for sales to the Metals Reserve Co. Magnesium-alloy ingot maximum prices included in the above regulation were: Incendiary bomb alloy, 23.4 cents; 50–50 magnesium-aluminum alloy, 23.75 cents; A. S. T. M. B 80–41 T 11 and A. S. T. M. B 94–41 T 13, 25 cents; and all other alloys, 23 cents. By Amendment 1 to Maximum Price Regulation 314, manufacturers of primary magnesium alloys, except those who also produce the metal, were allowed to carry out contracts with Government agencies at prices prevailing before February 1 to avoid loss on inventories of the metal and its alloys they had on hand at that date. On May 26 in Amendment 2, sellers of all magnesium or magnesium-alloy ingot manufactured in nonstandard shapes and sizes were permitted to add a premium of 1 cent a pound to applicable maximum base prices provided that the purchaser specifically requested the particular shape or size. On August 4 sellers of the above-mentioned nonstandard shapes or sizes that could not be produced for the 1-cent-a-pound premium were authorized in Amendment 3 to submit proposed prices to the Office of Price Administration for approval.

On December 29, 1943, Amendment 4 added a maximum price of 23.5 cents a pound for "selected magnesium crystals, crowns, and muffs" which included all packing, preparation, and handling charges. Also added to the regulation was a stipulation that a charge of one-half cent a pound may be added to the applicable maximum base price of magnesium or magnesium-alloy ingot, other than selected crystals, crowns, and muffs, for paper packaging or shipping in wire-bound bundles. On March 11, 1944, by Amendment 5, the Office of Price Administration placed magnesium powder under Maximum Price Regulation 314, and ceiling prices remained at the highest prices charged by individual sellers during March 1942.

Magnesium scrap and remelt ingot, controlled under the General Maximum Price Regulation during 1942, were placed under specific maximum prices by Maximum Price Regulation 302, effective January 20, 1943. For scrap, lots of less than 1,500 pounds, the prices were set as follows: Segregated plant scrap—all exempt except borings and turnings—8 cents a pound; contaminated plant scrap, 11 cents for grade 1 solids and 9 cents for grade 2 solids, and 7 and 5 cents, respectively, for grades 1 and 2 borings and turnings; obsolete scrap, uncontaminated, 11 cents, and contaminated, 9 cents. For lots of more than 1,500 pounds 1 cent may be added to the maximum price in each category. Actual costs of transportation may also be charged. Prices for remelt magnesium ingot were set at 21.5 cents a pound for class A, 18.5 cents for class B, and 16 cents for class C, Premiums may be added to these prices for transportation charges, when quantities are less than 20,000 pounds, as follows: One-fourth cent from 10,000 to 20,000 pounds, one-half cent from 1,000 to 10,000 pounds, and 1 cent for less than 1,000 pounds. Amendment 1 to this regulation, effective July 1, allows payment of a service charge to scrap dealers for loading scrap into railroad cars and exempts remelt magnesium ingot containing 99 percent or more magnesium from price control.

FOREIGN TRADE[3]

Imports of magnesium in all forms in 1943, all of which came from Canada, totaled 189 pounds valued at $86 and consisted of 28 pounds of metal and scrap; 135 pounds classed as sheets, tubing, ribbon, etc.; 8 pounds of alloys; and 18 pounds of powder.

Exports of magnesium from the United States, 1942–43

	1942		1943	
	Short tons	Value	Short tons	Value
Magnesium metal in primary form	4,045	$1,945,164	[1] 35,631	$16,272,607
Magnesium metal in other forms	149	99,517	2,673	1,475,303
Magnesium powder	22	66,038	2,125	1,207,429

[1] Includes 20,911 tons of magnesium-base alloy.

Exports of metal in primary form included 31,894 tons which went to the United Kingdom, 3,623 to the U. S. S. R., 70 to Canada, 40 to Mexico, and 4 tons to Turkey, Newfoundland, Labrador, and Haiti. Of the magnesium metal in other forms, 2,505 tons were destined to the United Kingdom, 134 to Canada, 11 to Australia, 20 to Mexico, and 3 to Panama Canal, Brazil, Newfoundland and Labrador, Chile, Uruguay, Argentina, China, and the Union of South Africa. Magnesium powder exported during the year included 2,088 tons destined to the United Kingdom, 16 for Australia, 9 each for Canada and the Union of South Africa, and 3 for China, Mexico, Peru and Brazil.

In 1943 exports of magnesium metal in primary form were equivalent to about 19 percent of the total domestic production compared with 8 percent in 1942.

WAR MEASURES

Magnesium General Preference Order M-2-b, now in force, was originally issued on November 14, 1941, to conserve and direct the distribution of magnesium. On December 31, 1942, the order was extended indefinitely and amended by omission of all references to preference ratings since the supply of magnesium and magnesium products is allocated directly to users. By an amendment to the order on January 13, 1944, the War Production Board simplified procedures governing the allocation and use of magnesium and magnesium products and the segregation and disposal of scrap. The amendment permits foundries to accept the return of rejected or spoiled castings of their own manufacture without obtaining prior approval of the War Production Board; they will no longer be required to sell such castings to a producer or approved smelter. The amendment also redefines "magnesium scrap" to exclude sawings, grindings, sweepings, and similar fines and also dross and sludge containing less than 20 percent magnesium by weight. Plants generating less than 1,500 pounds of scrap a month are freed from the requirement that they segregate their scrap, but those generating more than this amount must segregate it in accordance with A. S. T. M. alloy designations to facilitate its hauling and reprocessing. By Directive 34, the War Production Board on January 17, 1944, delegated authority to grant specific authorizations to deliver magnesium products going into aircraft and aircraft equipment to the Aircraft Scheduling Unit of the Aircraft Resources Control Board.

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[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TECHNOLOGIC DEVELOPMENTS

Improvements in magnesium-fabricating techniques have paced expanding production. Among the more important of these has been an improved stability of alloys, made possible largely through more careful control of their purity. For instance, it has been found that if the iron content is controlled to very close limits, corrosion resistance is materially increased.[4] A new method devised for satisfactorily arc-welding magnesium sheet or other products utilizes a tungsten electrode and a filler rod of the alloy being welded, the arc being maintained in a neutral atmosphere such as that provided by helium gas.[5] Wartime needs have increased knowledge on plastic working of magnesium alloy sheet,[6] sand casting of magnesium alloys,[7] and the technology of production of magnesium-base alloys.[8] Surface protection of magnesium and its alloys is essential because the resistance of the metal to corrosion is lowered in climates of high humidity and temperature, and there has therefore been considerable research on coating methods.[9] Knight [10] reviewed the latest methods for the prevention and control of magnesium fires and concluded that G–1 powder, "a mixture of graphite and complex materials," was probably the most efficient medium for extinguishing magnesium fires.

The application of a process of "mechanical ingoting" of magnesium and aluminum borings and turnings has recently been devised by which this type of scrap, if segregated at the point of origin and kept clean, can be made into ingot suitable for melting as well as deoxidation and alloying.[11] Solid ingots of practically 100-percent density are said to result from this method, with a metal recovery of virtually 100 percent.

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[4] Bakken, H. E., Aluminum and Magnesium: Metals and Alloys, vol. 19, No. 1, January 1944, p. 72.

[5] Kempf, L. W., Nonferrous Physical Metallurgy: Min. and Met., vol. 25, No. 446, February 1944, pp. 105–106.

[6] Lehnhardt, C. E., Plastic Working of Magnesium Alloy Sheet: Iron Age, vol. 151, No. 11, March 18, 1943, pp. 45–51.

[7] Fox, F. A., The Sand-Casting of Magnesium Alloys: Metal Ind., vol. 62, No. 15, April 9, 1943, pp. 226–230.

[8] Fox, F. A., Magnesium Alloy Technology; Metal Ind., vol. 64, No. 7, February 18, 1944, pp. 101–103.

[9] Barmesel, S. H., Surface protection of Magnesium: Iron Age, vol. 151, No. 16, April 22, 1943, pp. 44A–44D. Holman, E. R., and Roberts, J. P., Surface Treatment for Magnesium: Metals and Alloys, vol. 18, No. 6, December 1943, pp. 1331–34.

[10] Knight, H. A., Preventing and Extinguishing Magnesium Fires: Metals and Alloys, vol. 17, No. 5, May 1943, pp. 960–966.

[11] Stern, Max, Mechanical Ingoting; Iron Age, val. 152, No. 17, August 12, 1943, pp. 90–92.

A number of patents relating to magnesium were granted during 1943. Among those relating to the production of metallic magnesium from its ores are the following: The Pidgeon ferrosilicon reduction process (United States Patent 2,330,143); and at least five variations on the carbothermal reduction process wherein magnesium is released from its oxide as a vapor and must be shock-cooled to prevent the reversible reaction from taking place—the method of cooling being the main variant in the patents—(United States Patents 2,308,418, 2,323,597, 2,328,202, 2,330,724, and 2,334,451). At least 10 different patents relating to coating and protecting magnesium and magnesium alloy surfaces were granted. Agents proposed for producing corrosion-resistant surfaces include aqueous solutions of fluorides; solutions of chromic acid; solutions of basic aluminum nitrate and at least one alkali chromate with a suitable wetting agent; and an arsenic compound dissolved in water. Other patents granted during the year include a number relating to recovery of magnesium scrap and many covering new alloy combinations of magnesium.

POST-WAR OUTLOOK

With a domestic capacity to manufacture magnesium totaling 293,000 tons annually by the middle of 1944—90 times the pre-war (1939) capacity—it is apparent immediately that peacetime uses must be greatly expanded to consume any substantial percentage of available metal. All magnesium is now being used for war purposes—planes, incendiaries, and other battle equipment—and for essential civilian and war-supporting industries. For the most part these uses will virtually cease when hostilities terminate, and new and expanded peacetime uses must be found unless a large segment of the production industry as well as many fabricating plants are to be closed for a long period of time.

Magnesium has proved its worth in aircraft construction, particularly in landing gear, fuel tanks, instrument panels, and certain engine parts as magnesium base-alloy sheet and castings. Wartime experience and advances have shown that the metal is easily machined and that its alloys with aluminum, zinc, and copper are not only very light but high in strength. It is conceivable that by using alloying, casting, and forming techniques learned during the war manufacturers of motor cars and other transportation facilities will find uses for the metal in their post-war products. Excellent machinability and damping characteristics, as well as the nonsparking and nonmagnetic properties of magnesium, are arguments in favor of wider peacetime adoption of the metal. Certain disadvantages, limiting the use of the metal in some fields, should be borne in mind when post-war plans are being made. These include (1) a lower modulus of elasticity than steel and aluminum, (2) higher thermal expansion, (3) lower corrosion resistance, (4) greater reduction in strength with temperatures over 300° C. than steel and aluminum, and (5) susceptibility to the effect of concentrated stresses.

Cost of the metal is perhaps one of the most important considerations in evaluating post-war possibilities for its use. The present cost—20.5 cents a pound—is higher than that of both aluminum and copper, but when taken volume for volume it is less expensive. Further reductions in cost will undoubtedly be forthcoming after the war through advances in technology and reduced operating costs, and these reductions will have a pronounced effect on the promotion of large-scale use of the metal. Part of the price question hinges on the payment the Government will demand for productive facilities, of which it owns the preponderant share. The construction costs of the Government-owned facilities, built with public funds under the stress of war, will seem exorbitant by peacetime standards.

One fact that will loom important in the long-term outlook for magnesium is its abundance in the earth's crust, ranking third among the metals. Commercial sources of the metal include sea water, a virtually inexhaustible resource; dolomite, which occurs in large sedimentary deposits throughout the world; underground brines; and magnesite. For practical purposes, reserves of all of these except magnesite are limitless. Other sources that may be used in the future include olivine and serpentine—silicates of magnesium—which are found in great quantities in various parts of the world.

WORLD PRODUCTION

World production of magnesium in 1943 reached another all-time high mark of more than 269,000 metric tons—92 percent more than the previous record of 140,000 tons set in 1942 and more than eight times the 1939 output. The statistical background for the production figures of nations other than the United States, Canada, and the United Kingdom is very weak, but upon the basis of estimates it is thought that about 28 percent of the output was under Axis control and 72 percent under control of the United Nations. Production in 1944 will not greatly exceed that of 1943, inasmuch as all the major expansion programs of the various nations are thought to be virtually complete.

Estimated world production of magnesium, 1939–43, by countries, in metric tons

Country	1939	1940	1941	1942	1943
Australia	....	....	200	430	800
Canada	....	....	[1] 5	[1] 367	[1] 3,243
France	2,500	2,000	3,000	3,000	3,000
Germany	16,500	25,000	35,000	50,000	50,000
Italy	300	500	2,500	5,000	5,000
Japan	2,000	3,000	5,000	12,000	15,000
Norway	....	....	100	2,000	2,000
Switzerland	750	750	1,000	1,500	1,500
U. S. S. R.	1,000	1,500	4,000	5,000	5,000
United Kingdom	4,831	6,500	12,000	16,500	17,000
United States	[1] 3,039	[1] 5,680	[1] 14,782	[1] 44,418	[1] 166,544
Total	30,900	44,900	77,600	140,200	269,100

[1] Actual production.

Canada.—According to the Dominion Bureau of Mines, the output of magnesium in Canada has increased from 5 metric tons in 1941 to 3,243 tons in 1943. The Ministry of Munitions and Supply stated in June 1943 that the output of Dominion Magnesium, Ltd., at Haley's Station near Renfrew, Ontario, was meeting all Canadian requirements and allowing some margin for exports. Production of metal, using nearby dolomite as the raw material for the Pidgeon process, is stated to have reached the rated capacity of 10 tons a day. Latest reports of the cost per pound of the metal produced in this ferrosilicon plant are that in March 1943 costs had been lowered to 39.7 cents a pound. The Minister of Munitions and Supply stated that it was hoped costs could be brought down to the level of the electrolytic process.

Dominion Magnesium, Ltd., has begun the production of alloy munition castings, presumably incendiary bomb casings, at Haley's Station.

Early in 1944 it was announced that magnesium, the entire output of which was formerly used for war requirements and for export, is now permitted to be sold on the free market.

Japan.—Two new companies were formed during the year—Nippon Kazei-Kyogo by the Mitsubishi Co. in Kwantung Leased Territory of China, at a capitalization of 200,000,000 yuan, which is planned to begin operations in the fall of 1944, and the Imperial Magnesium Co. in Japan proper, through the merger of the Toa Light Metals Co. and the Okura Magnesium Mining Co., with a capitalization of 20,000,000 yen.

Norway.—In July 1943 the newly completed magnesium plant at Heroya was completely destroyed during an American air raid.

Sweden.—All restrictions on sales of magnesium and its alloys, semifinished products, magnesium ashes, scrap, and waste were abolished on March 1, 1944.

United Kingdom.—Four companies are operating magnesium plants in Great Britain, and each uses a different process. Since 1935 a subsidiary of Murex, Ltd., has used calcium carbide as a reducing agent. A mixture of carbide and magnesia is heated in vertical gas-fired retorts of heat-resisting steel under a vacuum. Calcined dolomite may be used to produce the metal, which is recovered in crystal form, but the yield is reduced by the amount of lime in the dolomite.

International Alloys, Ltd., operates a plant utilizing sea-water magnesia, which is finely ground and briquetted with aluminum or an alloy containing aluminum. The briquets are placed in electric resistance furnaces and heated to 1,100° to 1,250° C. under pressure of less than 4 mm. The magnesium is then distilled off and collected as high-purity crystals in the cooler part of the retort. This process is similar in nature to the above calcium carbide process and to the Pidgeon or ferrosilicon process.

In 1935 Magnesium Electron, Ltd., was formed to operate an electrolytic process, patent rights for which were purchased from I. G. Farbenindustrie, A. G. The method is similar to that used by Basic Magnesium, Inc., near Las Vegas, Nev., which was patterned after the British plant although on a tenfold scale. The capacity of the British plant at Clifton Junction near Manchester is thought to be about 5,000 tons annually, and the process is considered the cheapest now operating in the Empire.

The Hansgirg process of carbothermal reduction of magnesia is used by Magnesium Metal Corporation, Ltd. Hydrogen is used in this plant, as at Radenthein, Austria, for shock-cooling the vaporized metal, but otherwise the process is quite similar to that used by Permanente Metals Corporation in California.

Reports early in 1944 indicate that one of the British plants has been closed and that two others may be curtailed.

ANTIMONY

By J. H. Schaum

SUMMARY OUTLINE

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SUMMARY

Although antimony continued under Government control throughout 1943, the largest supply on record not only permitted use restrictions to be relaxed, with a resultant gain in consumption, but enabled stocks to be increased. The new supply—almost entirely imported—came largely from Bolivia and Mexico in nearly equal amounts and was augmented by a marked advance in domestic production. By the end of the year the situation was so easy that antimony was removed from allocation control, effective January 1, 1944.

Domestic production of antimony ore increased 140 percent over 1942, but the metal content advanced only 91 percent—an indicated drop in the average grade from 42 percent in 1942 to 34 percent in 1943. The number of antimony mines in operation was about one-half that in 1942, the large gain resulting from expanded operations at one property which supplied over three-quarters of the output. The antimony content of antimonial lead produced from all classes of foreign and domestic ore declined, the drop being greater than a substantial gain in the recovery from scrap. Primary antimony available for consumption was 52 percent greater than in 1942. Actual consumption was less than the supply, and although industry stocks showed a 14-percent decrease, total inventories, including those held by the Government, gained 45 percent.

The price of antimony metal in less than carlots was quoted at 16.05 cents a pound in New York until June 3, when the benefits of a lower freight rate were passed on to consumers by reduction of the selling price to 15.84 cents a pound. The average price of 15.92 cents in 1943 compares with 15.55 cents in 1942 and 14.00 cents in 1941 and 1940. The prices for antimony ore and concentrates remained unchanged throughout 1943. The 50- to 55-percent ores were quoted at $2.10 to $2.20 per short-ton unit of contained antimony at New York.

Figure 1 shows trends in world production from 1910 to 1938 and United States imports and prices from 1910 to 1943.

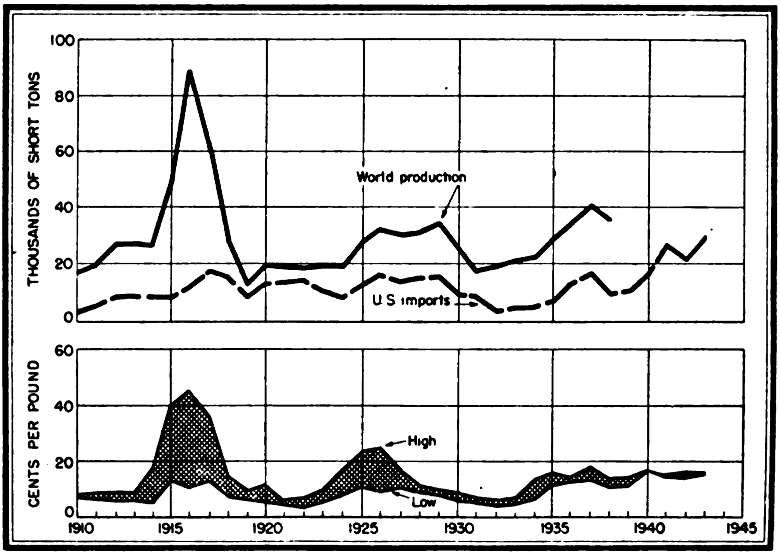

FIGURE 1.—Trends in world production, 1910–38, and United States imports and New York price of antimony, 1910–43.

Salient statistics for antimony in the United States, 1939–43

	1939	1940	1941	1942	1943
Production of antimony ore and concentrates......short tons..	3,174	1,124	3,460	6,960	16,785
Antimony contained......do....	393	494	1,214	2,944	5,637
Antimony content of antimonial lead produced from domestic and foreign ores......short tons..	1,108	2,077	2,958	3,267	2,294
Secondary antimony produced......do....	9,810	11,421	21,629	18,200	15,483
Imports for consumption:					
Antimony in ore......do....	9,448	15,733	19,386	20,946	28,738
Needle or liquated antimony......do....	228	113	638	522	1
Metal......do....	1,045	209	7,469	127	932
Oxide and other compounds......do....	173	5	2	(1)	(1)
Exports of antimony ore, metal, and compounds......do....	[2] 58	[2] 276	[2] 70	230	494
Primary antimony available for consumption......do....	11,609	17,955	29,994	23,852	36,182
Stocks of antimony in bonded warehouse at end of year..do....	685	3,417	416	(3)	(3)
Average price of antimony at New York:[4]					
Chinese......cents per pound..	14.44	[5] 16.50	[5] 16.50	[5] 16.50	[5] 16.50
American......do....	12.36	14.00	14.00	15.55	15.92
World production......short tons..	(3)	(3)	(3)	(3)	(3)

[1] Less than 1 ton.
[2] Includes only foreign metal.
[3] Figures not available.
[4] According to American Metal Market.
[5] Nominal.

POST-WAR OUTLOOK

Domestic production of primary antimony has been stimulated by war conditions, but most of the gains were made at mines operated chiefly for other metals. The increase at the Yellow Pine mine in Idaho has been notable, but operations at this property are predicated largely on the demand for tungsten, the more valuable constituent of the ore mined. Antimony in the United States has always been largely produced as a byproduct, and present indications are that it will remain so in the future. Primary antimony requirements will therefore continue to be met by imports, chiefly in the form of ore from Mexico and Bolivia, as the present tariff on antimony favors the importation of ore rather than metal. Demand for antimony in the post-war period probably will exceed the pre-war level, partly because of the large requirements for storage batteries and other metal products and also because of new applications developed during the war, notably the use of antimony oxide in the preparation of flame-proofing and mildew-proofing compounds for treating canvas and other textiles.

DOMESTIC MINE PRODUCTION

Only 17 antimony-producing mines operated in 1943 compared with 31 in 1942, but a record output of 5,637 tons of antimony in 16,785 tons of ore almost doubled the 1942 production of 2,944 tons. The Yellow Pine mine supplied 77 percent of the mine output and practically all of the large gain. In terms of antimony content, 4,341 tons came from tungsten-gold-antimony ore, 971 tons from silver-copper-antimony ore, 182 tons from antimony ore, and 143 tons from gold-antimony ore. Such past producing States as California, Montana, and Washington had no production of antimony ore during the year.

Alaska.—Aided by extensive exploration by the Geological Survey and the Bureau of Mines, antimony mining in Alaska showed increased activity. At least nine operators contributed 184 tons of antimony in ore during 1943. The Metals Reserve Co. purchasing depot at Fairbanks increased its holdings from 15 tons of ore (antimony content) on January 1, 1943, to 96 tons on January 1, 1944. The terms for the purchase of antimony ores in Alaska were extended to December 31, 1944. These prices were practically the same as those paid for domestic ores in the United States by Metals Reserve Co., as listed in the section of this chapter reviewing prices.

According to the Geological Survey, in 1941 the estimated reserves of proved and probable antimony ore in the Stampede Creek area, 120 miles southwest of Fairbanks, were 70 tons of 50-percent or better ore, 6,000 tons of 10- to 15-percent ore, 1,000 tons of 20-percent ore as loose material below the surface ore body, and 5,000 tons of mill tailings carrying about 6 percent antimony. The ore consists of lenses and veins of stibnite disseminated in quartz veins as veinlets in schist.

In the summer of 1942 the Bureau of Mines completed a successful exploration of the Mooney ore shoot of Earl Pilgrim's Stampede mine in the Kantishna district. As a result of mining this antimony ore and reprocessing some accumulated tailings, Stampede continued to be the largest producer in Alaska.

The Slate Creek mine, also in the Kantishna district, owned by Ernest Maurer, was the only other large operation and produced 90 tons of ore averaging 47 percent antimony.

Several promising areas were investigated by the Geological Survey. These included a stibnite deposit at Caamano Point, Cleveland Peninsula, and the quicksilver-antimony deposits in the Sleitmut area of the Georgetown district. Signs of mining activity were apparent in the Wood River area and the Tok River area. Several individuals collected small quantities of antimony ore stored at the gold-antimony mines in the Fairbanks district and shipped the material to the Fairbanks purchase depot.

Idaho.—Practically all of the domestic antimony ore is mined in Idaho, and in 1943 past production records were topped with a State total of 5,231 tons of antimony contained in concentrates produced.

The Yellow Pine mine at Stibnite, owned and operated by the Bradley Mining Co., has become one of the largest antimony mines in the world, with a 1943 output of 9,930 tons of antimony concentrates containing 4,341 tons of metal. The stibnite containing the antimony is intimately associated with scheelite, pyrite, arsenopyrite, gold, and silver. An urgent war need for tungsten effected a very large increase in activity at the Yellow Pine mine, and because of the nature of the deposit a considerable quantity of antimony was removed along with the tungsten. The ore was mined from an open pit and treated by flotation which yielded a scheelite concentrate, a gold concentrate, and an antimony concentrate averaging 50 percent antimony and 4.5 ounces of silver and 0.057 ounce of gold per ton. About one-third of the antimony mined remained unrecovered in the flotation tailings. As a result of the completion of a 106-mile power line carrying 66,000 volts of electricity into Stibnite the company plans to increase the 700-ton daily milling capacity to 1,000 tons.

In the Coeur d'Alene district antimony is recovered from complex "dry belt" ores such as tetrahedrite valued principally for its silver. The largest producers in this area were the Sunshine Mining Co. in Kellogg and the Coeur d'Alene Mines Corporation in Wallace. Sunshine operated a 1,200-ton concentrator, and Coeur d'Alene had a 600-ton mill. Most of this concentrate was directed to the new electrolytic plant of the Sunshine Mining Co. and refined into cathode metal.

The Polaris Mining Co. in Wallace produced silver-copper and silver-iron concentrates containing 53 tons of antimony.

Nevada.—Antimony-mining activity in Nevada showed a marked decrease during 1943. B. E. Gallagher operated the Antimony King mine, Sam Watkins the W. P. mine, Tony Romano and Robert Roecker the Bray mine, Anna Rechel the Happy Returns property, Lillie Pesi the Apex mine, and William Choate a mine in Washoe county. These six operators produced 84 tons of ore containing 32 tons of antimony, a sharp drop from the 1942 output of 305 tons containing 96 tons of metal.

Oregon.—This State made an excellent showing with 107 tons of antimony in 632 tons of ore mined. About 89 tons of this antimony was in gold-antimony ore from the Gray Eagle mine in the Virtue district, Baker County. This mine was owned by Pat O'Brien but operated in turn by Smith, Hubbard, Larson, and Estes until the middle of the year, when it was bought by Anthony Brandenthaler.

Emerson Merrick operated the Blue Jay mine on the Applegate River near Medford and produced 34 tons of stibnite concentrates averaging 51 percent antimony.

Utah.—With the aid of a Reconstruction Finance Corporation mine loan the Dry Lake Mining Co. was able to produce 6 tons of ore averaging 50 percent antimony. This mine, in Hunsaker Canyon, Brigham City, was the only active one in the State.

CONSUMPTION AND PRODUCTION BY SMELTERS AND MANUFACTURERS

Primary antimony raw materials were consumed by smelters that produce antimony metal, oxide, and sulfide and by manufacturers that make finished metal and nonmetal products. Together the smelters and manufacturers used 23,505 tons (antimony content) of antimony ore in 1943—7 percent higher than 1942. More than 56 percent (13,224 tons) of the antimony ore consumed in 1943 was mixed or oxide ore, virtually all of which originated in Mexico.

Antimony ore and concentrates at smelters and manufacturers in 1943

[Short tons of contained antimony]

Raw materials	Stocks on Dec. 31, 1942	Net receipts	Consumption	Stocks on Dec. 31, 1943
Chemical-grade sulfide ore	860	4,193	4,716	337
Metallurgical-grade sulfide ore	763	1,857	2,220	400
Mixed or oxide ore	1,139	12,988	13,224	903
Sulfide concentrates	1,078	2,965	2,482	1,561
Tetrahedrite concentrates	50	813	863	-----------
Total ore	3,890	22,816	23,505	3,201

Smelter production.—Eleven plants consumed approximately 22,400 tons of primary antimony materials, including 18,457 tons of antimony in ore, and produced 20,624 tons of antimony metal, oxide, and sulfide. The Bureau of Mines is not at liberty to publish separate figures for production of these three products. Antimony metal was produced in the United States at four plants, oxide was manufactured at seven plants, and sulfide at five plants. Capacity operations were prevented at several plants by labor shortages, but output exceeded that of 1942 by 20 percent.

Texas Mining & Smelting Co., Laredo, Tex., the largest antimony smelter in the country, continued to use almost entirely the oxidized antimony ores from Mexico in the production of metal, oxide, and sulfide. Granulated cathode metal averaging 96 or 97 percent antimony was the end product of the electrolytic refinery of the Sunshine Mining Co., Big Creek, Idaho. This refinery is the newest in the country (having started operations in September 1942) and treats tetrahedrite ores obtained from its own mines and from the Coeur d'Alene Mines Corporation. At the beginning of 1943 Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho, produced antimony metal at its electrolytic refinery from complex tetrahedrite ores but later in the year changed over to Yellow Pine stibnite concentrates. The El Segundo (Calif.) plant of the Harshaw Chemical Co. smelted stibnite concentrates from the Yellow Pine mine and produced both metal and oxide. The Elyria (Ohio) plant of Harshaw Chemical Co. manufactured antimony oxide and sulfide from metal and chemical grade sulfide ore. At Perth Amboy, N. J., the American Smelting & Refining Co. has a relatively new and unique plant which made antimony oxide from antimonial lead and produced impure antimony metal by reduction of flash-roasted sulfide concentrates. Other plants producing antimony oxide and sulfide were American Smelting & Refining Co., Omaha, Nebr.; McGean Chemical Co., Cleveland, Ohio; Metal & Thermit Corporation, Carteret, N. J.; Rare Metal Products Co., Belleville, N. J.; and Ceramic Color & Chemical Manufacturing Co., New Brighton, Pa.

Production by manufacturers.—In 1943 over 300 plants consumed 19,691 tons of primary antimony raw materials, including 5,048 tons of antimony in ore, and produced 19,508 tons of finished products which are listed in the following table. Slightly more primary antimony was recovered in nonmetal than in metal products. Flameproofing of canvas for such military uses as tents, tarpaulins, camouflage netting, and life preservers proved to be the largest end use for primary antimony. The consumption of antimony in frits and ceramic enamels was sharply curtailed by the exigencies of war.

Production of finished products containing antimony in 1943

[Short tons of contained antimony]

Antimonial lead	[1]2, 880	Flameproofed textiles	6, 952
Batteries and parts	[1]2, 400	Paints and lacquers	1, 859
Bearing metals and bearings	[1]1, 563	Glass and pottery	537
Type metal and type	856	Frits and ceramic enamels	281
Cable covering	447	Antimony trichloride	153
Ammunition	389	Sodium antimonate	47
Castings	198	Ammunition primers	97
Sheet and pipe	176	Matches	18
Collapsible tubes and foil	132	Other	385
Solder	129		
Other	9	Total nonmetal products	10, 329
Total metal products	9, 179		

[1] Partly estimated.

The primary lead smelters produced 63,515 tons of antimonial lead containing 3,371 tons of antimony. The antimony content dropped to 5.3 percent, largely because of the increased quantity of antimonial lead low in contained antimony produced for bullet-core rod. The distribution of the antimony according to source showed some interesting changes. In 1943, 55 percent of the antimony in antimonial lead produced at primary lead smelters was derived from domestic ore, 32 percent from scrap, and 13 percent from foreign ore compared with 68 percent from domestic ore, 7 percent from scrap, and 25 percent from foreign ore in 1942. The total primary antimony recovered in antimonial lead at lead smelters and all other plants amounted to 4,664 tons in 1943.

Antimonial lead produced at primary lead refineries, 1939–43, in short tons

Year	Production	Antimony content				
		From domestic ores [1]	From foreign ores [2]	From scrap	Total	
					Quantity	Percent
1939	21, 995	929	179	923	2, 031	9. 2
1940	29, 762	1, 915	162	867	2, 944	9. 9
1941	40, 237	2, 586	372	552	3, 510	8. 7
1942	51, 762	2, 396	871	257	3, 524	6. 8
1943	63, 515	1, 848	446	1, 077	3, 371	5. 3

[1] Includes primary residues and small quantity of antimony ore.
[2] Includes foreign base bullion and small quantity of foreign antimony ore.

STOCKS

Combined producer and consumer inventories of antimony ore, concentrates, metal, oxide, and sulfide decreased 14 percent from 9,440 tons on December 31, 1942, to 8,089 tons on December 31, 1943. Augmenting the total industry-owned stocks of 8,089 tons of primary materials on hand December 31, 1943, were mine stocks of 3,826 tons and Metals Reserve stocks of 10,511 tons of foreign ore, 159 tons of domestic ore, and 12,848 tons of antimony metal. Thus the supply of raw materials available for the manufacture of finished products totaled 35,433 tons (antimony content) at the end of 1943 compared with 24,425 tons at the end of 1942.

SECONDARY PRODUCTION

A detailed review of the secondary antimony industry is presented in the Minerals Yearbook chapter on Secondary Metals—Nonferrous. The recovery of secondary and primary antimony in finished products during the year totaled 15,483 tons from scrap and 19,508 tons from primary materials. Almost two-thirds of the antimony in metal products was derived from scrap. Old battery lead plates continued to supply the bulk of this secondary antimony.

PRICES

The price of domestic brands of antimony metal was quoted at 16.049 cents a pound for less than carlots in New York from January 1 through June 2. As a result of permission to ship antimony from Laredo, Tex., to Jersey City, N. J., at transcontinental freight rates a reduction of $3.74 per ton in freight charges was passed on to the buyers. Thus the New York price has been quoted at 15.839 cents a pound since June 3 and continued throughout the remainder of 1943. Carlot prices opened the year at 15.509 cents a pound and dropped to 15.452 cents on May 15 and again to 15.265 cents on June 3. Virtually no Chinese metal was available in 1943, and the purely nominal price of 16.50 cents in effect since November 1939 remained unchanged in 1943.

A base ceiling price of 14.50 cents a pound for 99- to 99.8-percent antimony metal was established by the Office of Price Administration under the new Price Regulation MPR-497, effective December 9, 1943. Imported antimony metal and domestic metal have the same maximum price, and 15 other compounds (including the oxide and sulfide) were put under this new regulation. Previously the antimony price

Average monthly quoted prices of antimony, prompt delivery at New York, 1939-43, in cents per pound, for less than carlots

Month	Chinese brands (duty paid) [1]					American brands [2]				
	1939	1940 [3]	1941 [3]	1942 [3]	1943 [3]	1939	1940	1941	1942	1943
January	14.00	16.50	16.50	16.50	16.50	11.68	14.00	14.00	14.00	16.05
February	14.00	16.50	16.50	16.50	16.50	11.25	14.00	14.00	14.00	16.05
March	14.00	16.50	16.50	16.50	16.50	11.27	14.00	14.00	14.62	16.05
April	14.00	16.50	16.50	16.50	16.50	11.50	14.00	14.00	15.90	16.05
May	14.00	16.50	16.50	16.50	16.50	11.70	11.00	14.00	16.01	15.94
June	14.00	16.50	16.50	16.50	16.50	12.00	14.00	14.00	16.01	15.84
July	14.00	16.50	16.50	16.50	16.50	12.00	14.00	14.00	16.01	15.84
August	14.00	16.50	16.50	16.50	16.50	12.00	14.00	14.00	16.01	15.84
September	14.00	16.50	16.50	16.50	16.50	12.87	14.00	14.00	16.01	15.84
October	14.24	16.50	16.50	16.50	16.50	14.00	14.00	14.00	16.01	15.84
November	16.50	16.50	16.50	16.50	16.50	14.00	14.00	14.00	16.01	15.84
December	16.50	16.50	16.50	16.50	16.50	14.00	14.00	14.00	16.02	15.84
Average	14.44	16.50	16.50	16.50	16.50	12.36	14.00	14.00	15.55	15.92

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[1] From daily issues of American Metal Market, except 1939, which was taken from Metal Statistics, 1940, p. 529.

[2] Metal Statistics, 1944, p. 559.

[3] Nominal.

was governed by the General Maximum Price Regulation based upon the highest prices charged during March 1942.

Prices for English regulus (minimum 99-percent antimony) and foreign regulus (spot deliveries from warehouse) remained unchanged throughout 1943 at £120.

Quotations for antimony ore and concentrates on January 1, 1943, according to E. & M. J. Metal and Mineral Markets, were as follows: "Per (short-ton) unit of contained antimony, at New York, 50 to 55 percent, $2.10 @ $2.20; 58 to 60 percent, $2.15 @ $2.20; 60 to 65 percent, $2.20 @ $2.30. London, 60 to 65 percent, 12s. 6d. per long-ton unit, nominal." These prices remained unchanged throughout 1943.

The following rates per short-ton unit of contained antimony were paid by the Metals Reserve Co. for domestic antimony ores delivered at a purchase depot: 20-percent ore, $1.15; 25-percent, $1.40; 30-percent, $1.65; 40-percent, $1.75; 50-percent, $1.85; 55-percent, $1.925; 60-percent, $2.00; 70-percent, $2.15.

WAR AGENCY REGULATIONS

The War Production Board continued to coordinate antimony supply and demand in 1943 by means of General Preference Order M-112. An amended version of this order, issued March 8, relaxed restrictions on the use of antimony in automotive battery plates and other approved alloys. Privilege was also granted to use antimony in any form for manufacture of white pigments, opacifiers, and frits for non-acid-resisting ceramic enamels. No change was made in the 50-ton limit on the permissible antimony content of unallocated ores and concentrates, but the maximum size of unallocated deliveries of antimony metal and alloys was raised from 25 pounds to 2,240 pounds a month.

Effective February 1, 1943, antimony was reclassified from group II to group III of the Material Substitutions and Supply List of strategic minerals. Group II is composed of essential war materials, supplies of which are in balance with immediate demand, and group III includes materials available in significant quantities, which are particularly recommended as substitutes for critical materials.

The improved position of antimony became apparent when it was removed from allocation control of the War Production Board by amendment to General Preference Order M-112 on December 4, effective January 1, 1944. Consumers were still required to file reports of their activities with the War Production Board upon a quarterly instead of monthly basis.

TECHNOLOGIC DEVELOPMENTS

As a result of the war there has been an unprecedented demand for canvas that is flameproof, waterproof, and mildew-resistant. Canvas is endowed with these characteristics by dipping it into a compound containing antimony oxide, chlorinated paraffin, paint pigments, and several other constituents. The treated canvas will burn if heat is supplied from an external source, but it will not support combustion after the source of heat is removed. A fireproof adhesive cement of similar composition has been developed to hold fiber-glass insulating walls to the steel partitions and sides of Navy ships.

Because infrared photography revealed most camouflage painting it has been necessary to develop paints with the same infrared reflectance characteristics as the surrounding green foliage. Chromium oxide and antimony sulfide are the two most important dark pigments with these characteristics, which make them essential for use in camouflage paints.

Before the war antimony in solder was usually considered an impurity rather than an alloying agent. However, the present shortage of tin has led to the substitution of antimony for tin in some solders. A general rule defining this practice is that the tin content can be reduced 2 percent for each percent of antimony added until the antimony reaches 6 percent of the tin content. One of the most popular "war" solders analyzes 2 percent antimony, 30 to 40 percent tin, and the remainder lead.

In 1942 the Metalurgica de Mexico, S. A., completed a unique smelter at Tlalnepantla, Mexico. This smelter was designed to recover antimony, mercury, and tin from complex Mexican ores, such as livingstonite ($HgS.2\ Sb_2S_3$). A concentrate of this ore is burned in a special sintering machine. The vaporized mercury is collected in a condenser, and the antimony sinter is treated in a blast furnace equipped with two crucibles interchangeable for antimony and tin.

Briefly, the new Sunshine Mining Co. electrolytic refinery produces antimony cathode metal in the following manner. The antimony contained in the tetrahedrite ore is put into solution by leaching 8 to 10 hours at 100° C. in a solution of Na_2S. After filtering, the pregnant solution is electrolyzed in diaphragm-type cells containing mild-steel anodes and cathodes. The resultant cathode metal contains about 96 or 97 percent antimony and is sold as such without further refining.

Several interesting patents concerning antimony were issued during the year. One involved partial removal of antimony from antimonial lead containing no tin by stirring litharge into the molten alloy. The antimony is oxidized and enters into a slag that can be easily withdrawn from the metal. Another patent removes antimony from lead-tin alloys by adding aluminum, magnesium, sodium, potassium, or calcium to the molten alloy. The antimony combines with the added metal to form an intermetallic compound of relatively high melting point, which rises to the surface and is skimmed off as a mushy dross. The antimony may be reclaimed by grinding the dross, heating it in a kiln through which a current of steam passes, and collecting the resulting antimony oxide in a bag house. A patent was issued for reduction of impure antimony trioxide to the metallic form. The oxide is mixed with about 12 percent carbon, put in a crucible made of a slag composed of approximately equal parts of sodium sulfate and common salt, sealed with hot slag, and heated to 1,300° C. in a reverbatory furnace to produce antimony metal with practically no volatilization loss. A new method for producing tartar emetic was accomplished by mixing finely divided antimony metal with nitric acid and potassium bitartrate. Boiling and refluxing this mixture, followed by evaporation and cooling, yield tartar emetic.

FOREIGN TRADE [1]

The following tables show imports and exports of antimony materials.

Antimony imported for consumption in the United States, 1939–43

Year	Antimony ore			Needle or liquated antimony		Antimony metal		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1939	21,000	9,448	$1,132,359	228	$30,102	1,045	$196,812	173	$29,786
1940	37,966	15,733	2,027,612	113	19,464	209	50,048	5	1,851
1941	41,662	19,386	2,717,472	638	126,018	7,469	2,056,678	2	537
1942	50,033	20,946	3,943,402	522	101,164	127	28,904	(1)	5
1943	63,187	28,738	5,351,852	1	172	932	267,916	(1)	3

[1] Less than 1 ton.

Antimony imported into the United States, 1942–43, by countries, in short tons [1]

Country	Antimony ore			Antimony metal	
	Gross weight (short tons)	Antimony content		Short tons	Value
		Short tons	Value		
1942					
Australia	757	418	$83,622		
Bolivia	12,436	7,471	2,050,919		
Canada	1	(2)	45		
Chile [3]	1,262	808	155,846		
Honduras [4]	150	93	18,645		
Mexico	35,863	12,405	1,701,735	28	$11,000
Peru	639	343	40,514		
United Kingdom [5]				19	4,778
	51,108	21,538	4,051,326	47	15,778
1943					
Bolivia	22,304	13,833	2,917,927		
Canada	(2)	(2)	55	(2)	13
Chile [3]	12	6	1,100		
Cuba	22	6	1,456		
Honduras [4]	236	144	37,408		
Mexico	37,621	12,673	1,983,943	643	203,301
Peru	3,119	2,131	404,328	289	64,596
Turkey	121	61	13,840		
United Kingdom [5]				(2)	6
	63,435	28,854	5,360,057	932	267,916

[1] Data include antimony imported for immediate consumption plus material entering the country under bond.
[2] Less than 1 ton.
[3] Probably mined in Bolivia or Peru and shipped from a port in Chile.
[4] Includes 25 tons of ore containing 13 tons of antimony in 1942 and 205 tons of ore containing 124 tons of antimony in 1943 mined in Honduras but credited by the Department of Commerce to Guatemala.
[5] United Kingdom of Great Britain and Northern Ireland.

Estimated antimony content in type metal, antimonial lead, and other alloys imported for consumption in the United States, 1939–43, in short tons [1]

Year	Type metal and antimonial lead	Other alloys [2]	Total	Year	Type metal and antimonial lead	Other alloys [2]	Total
1939	59	62	121	1942	35		35
1940	191		191	1943	281		281
1941	202		202				

[1] For details of gross weight and values, see imports shown in Lead chapter of this volume.
[2] Chiefly in special antimony-lead alloys containing high percentage of antimony.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Foreign antimony (regulus or metal) exported from the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	58	$16,736	1942	(1)	$181
1940	276	75,440	1943	(1)	200
1941	70	19,690			

[1] Less than 1 ton.

The United States continued to depend on foreign sources for its supply of antimony ore.

Bolivia provided the United States with 13,833 short tons (antimony content) of chemical-grade and metallurgical-grade sulfide ores in 1943, an 88-percent increase over 1942. The chemical-grade sulfide ore serves as an excellent raw material for the production of antimony oxide, but the metallurgical-grade ore is better-suited for use in making antimonial lead alloys. Since most of this high-grade ore has been placed in the Government stock pile, Metals Reserve Co. (the Federal purchasing agent) has curtailed to a minimum the 1944 purchases from Bolivia.

From Mexico came 12,673 tons of antimony in ore and 643 tons of metal. Virtually all the ore from Mexico was in the oxidized form.

As a result of the treatment of a large accumulation of lead-smelter flue-dust residues, Peru was able to ship 289 tons of metal as well as 2,131 tons in ore in 1943.

In addition to the actual receipts from Bolivia and Peru, a stock pile of 11,498 tons of antimony in concentrates purchased from these countries by the Metals Reserve Co. and awaiting shipment to this country was stored in Chile.

Total exports in 1943 included 291 tons of antimony metal, 95 tons in oxide, and 17 tons in sulfide.

WORLD PRODUCTION

Despite war censorship, a few more production figures were made available by foreign countries for past years, as well as for 1943. Information from Europe and Asia continued to be very meager. Several interesting figures on past production were obtained for Spain, Spanish Morocco, Czechoslovakia, Union of South Africa, and Southern Rhodesia. Data for North and South American output were practically complete. The Allies controlled about 80 percent of the world ouput, Yugoslavia, Czechoslovakia, and parts of China being the only large producers under Axis domination.

REVIEW BY COUNTRIES

Argentina.—The small requirements for antimony were met here by approximately 200 to 300 metric tons of domestically mined stibnite, supplemented by imports from Bolivia. Most of the ore came from the Pabellon mine at 14,500 feet altitude in the Cerro Granadas, Department of Rinconada, Province of Jujuy.

Australia.—The principal ore of antimony in Australia is stibnite, but cervantite, tetrahedrite, jamesonite, and bournonite also occur in appreciable quantities. Antimony sulfide was prepared by liquation from high-grade handpicked stibnite at the plant of O. T. Lempriere & Co., Ltd., Alexandria, Sydney, New South Wales. The

World production of antimony, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
North America:							
Canada	[2] 18	34	[3] 550	1,083	1,329	1,269	453
Honduras	--------	--------	--------	(4)	23	(4)	[5] 135
Mexico [6]	9,788	7,391	7,243	11,286	10,241	10,759	12,587
United States	1,056	542	328	412	1,013	2,457	4,963
South America:							
Argentina	31	174	97	91	107	53	(4)
Bolivia (exports)	6,556	8,682	9,255	10,813	13,680	16,231	16,536
Peru	1,296	753	775	809	1,440	1,338	2,189
Europe:							
Czechoslovakia	997	[3] 800	[3] 1,012	[3] 1,104	1,645	[3] 3,130	(4)
Germany (Austria)	200	145	(4)	(4)	(4)	(4)	(4)
Greece	--------	--------	1	(4)	(4)	(4)	(4)
Italy	414	740	(4)	(4)	(4)	(4)	(4)
Portugal	49	131	174	247	46	(4)	(4)
Spain	[7] 35	[7] 44	[8] 86	4	154	(4)	(4)
Yugoslavia	1,447	2,739	3,337	[3] 4,860	(4)	(4)	(4)
Asia:							
Borneo, British	4	--------	14	41	(4)	(4)	(4)
Burma	28	84	(4)	(4)	(4)	(4)	(4)
China [9]	14,702	7,797	6,497	5,493	(4)	(4)	(4)
Chosen	8	(4)	(4)	(4)	(4)	(4)	(4)
India, British	--------	11	(4)	(4)	(4)	(4)	(4)
Indochina	5	83	19	9	(4)	(4)	(4)
Turkey (Asia Minor)	536	398	460	[5] 264	(4)	(4)	(4)
Africa:							
Algeria	778	744	(4)	(4)	(4)	[10] 137	(4)
Morocco:							
French	20	125	(4)	(4)	(4)	[10] 72	(4)
Spanish	158	93	(11)	64	85	(4)	(4)
Southern Rhodesia	64	63	50	[5] 116	[5] 93	[5] 155	(4)
Union of South Africa	--------	10	6	126	420	[12] 689	[12] 1,045
Oceania:							
Australia:							
New South Wales	13	12	7	9	128	(4)	(4)
Queensland	(13)	8	--------	8	25	(4)	(4)
Victoria	145	195	100	14	15	(4)	(4)
Western Australia	[3] 245	324	296	214	297	(4)	(4)
New Zealand	--------	1	--------	1	8	(4)	--------
	38,600	32,100	(4)	(4)	(4)	(4)	(4)

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[1] Approximate recoverable metal content of ore produced exclusive of antimonial lead ores. 92 percent of reported gross content is used as basis for calculations in nearly every instance. Japan produces antimony but data on production are not available.

[2] Recoverable metal content of concentrates exported.

[3] Estimate.

[4] Data not available.

[5] Exports.

[6] Includes antimony content of antimonial lead.

[7] Smelter basis.

[8] Includes Spanish Morocco.

[9] Figures represent antimony content of regulus, crude antimony, and oxide exported.

[10] January to April, inclusive.

[11] Included in Spain.

[12] January to September, inclusive.

[13] 412 kilograms.

stibnite concentrates, which contain little or no gold, were treated at the same plant for production of metallic antimony, antimony oxide, and sodium antimonate.

Refined antimonial lead was made by the Electrolytic Refining & Smelting Co., Port Kembla, New South Wales, from antimonial slag resulting from smelting lead ores and refining bullion.

Most of the antimony formerly came from the Wiluna mines in Western Australia, but recent exhaustion precludes any production in 1943. Small, high-grade parcels of sulfide ore were obtained by selective mining from the Blue Spec mine in this vicinity. Antimony occurs as complex sulfides in lead ores at Broken Hill, from which source antimonial slag containing about 490 tons of antimony was produced for subsequent smelting.

Australian consumption averages about 1,000 tons of primary antimony as metal, in oxide, sulfide, sodium antimonate, and antimonial lead.

Bolivia.—More antimony ore was mined in Bolivia than in any other country in the world during 1943. The large number of small mines are located in the district of Tupiza, Department of Potosí, and Challapata, Department of Oruro. The stibnite ore occurs in quartz veins traversing narrow belts of fractured black slate. Much of the ore is wasted by primitive mining methods and by hand sorting to produce high-quality chemical-grade and metallurgical-grade concentrates. The ore is sold to the Banco Minero de Bolivia, which exports it to the foreign market.

In February 1943 the Metals Reserve Co., acting for the United States Government, signed a contract for the purchase of 9,000 tons of antimony in chemical-grade concentrates and 5,000 tons in metallurgical-grade concentrates. The 1944 Metals Reserve Co. contract calls for 5,000 tons of antimony in chemical-grade concentrates and no metallurgical-grade. As a result of this decrease in demand, many of the mines that could produce only metallurgical-grade concentrates were forced to close. As an emergency measure the Banco Minero has agreed to continue purchasing chemical-grade and also metallurgical-grade containing a minimum of 60 percent antimony and maximum of 1 percent lead and arsenic until March 31, 1944.

Near the end of April 1943 the Bolivian Government reduced the export tax on all mineral shipments except antimony, perhaps directing its tax policy toward discouragement of high antimony production.

Canada.—Canadian output was limited to a small quantity of electrolytic antimony made by the Consolidated Mining & Smelting Co. at Trail, British Columbia.

China.—Antimony production is reported to have ceased in Kwangsi during 1943. Mining villages were deserted, and mine owners were liquidating assets and selling machinery as scrap. A stock pile estimated to contain 31,000 metric tons of antimony had been accumulated between Kweilin and Kunming.

Between 70 and 80 percent of the Chinese antimony reserves are in Hsikuangshan, Singhua district, Hunan Province. Known reserves of China total 2,446,000 to 3,677,000 tons of contained antimony.

Czechoslovakia.—Czechoslovak refined-metal production in 1941 was estimated at 1,645 tons. A rapidly increasing supply of ore is coming from the mines near Bosing and Mezibroddon Allehota.

Honduras.—The largest active mine in Honduras is the El Quetzal, near San Augustin de Copan, owned by Manuel Bueso and Rodolfo Nater. The ore body is stibnite (partly oxidized near the surface), pyrite, and quartz and is mined from open-cuts. Production of the mine in 1941–43 was 450 tons of concentrate, averaging 58 to 62 percent antimony. The concentrate is transported with difficulty to the port of San José, Guatemala, where it is exported by Casa Bueso. La Union mine in the Department of Olancho has been active, as well as one near the town of Yoro and two others in the Department of Copan.

Italy.—The principal antimony property in Italy is the Su Suergiu mine in southeastern Sardinia. Other deposits are the Corti Rosas mine near Ballao and several in Sicily and northern Italy. A smelter operated at Villacidio in Sardinia produced antimony oxide and metal. Another smelter was built in 1940 at Rosia near Siena.

Japan.—Large deposits of antimony ore are reported to have been located at copper mines in the neighborhood of the town of Sapporo on Hokkaido Island.

Mexico.—Conversion of the mine of Compañía Minera de Oaxaca, near St. Juan Mixtepec, from underground to open-pit operations was completed early in 1943, but after a few months it was found advisable to return to underground methods because of the increased proportion of waste to be handled.

The new Tlalnepantla smelter of the Metalurgica de Mexico, S. A., commenced to produce metallic antimony, and Metals Reserve Co. agreed to buy the output.

Depletion of reserves and the lower price of mercury closed the Huitzuco livingstonite mine in Guerrero early in 1944.

Nova Scotia.—Antimony Mines, Ltd., has acquired the rights to work antimony mines near Rawdon from the St. Helena Mining Co. The seam is 7 inches wide, and recent samples assayed 40 to 55 percent antimony and 3.48 to 3.83 ounces of gold per ton.

Peru.—The Cerro de Pasco Copper Corporation had a large stock pile of flue dust containing bismuth and antimony at its Oroya lead smelter. A special plant for recovering these metals was completed in August 1942 and produced an impure metal containing 95 to 96 percent antimony. About 289 tons of this metal were shipped to the United States in 1943.

About half of the Peruvian antimony is mined in the Department of Puno, where the deposits are stibnite ore shoots in quartz veins traversing slate belts.

The Over-all Metals and Minerals Agreement between the Peruvian Government and the Metals Reserve Co. was signed in Lima on July 20, 1943, effective until June 30, 1944. The maximum quantity of antimony that Metals Reserve Co. agreed to purchase was not to exceed 100 percent of the 1942 exports produced in Peru, and the price was to be $2.10 per short-ton unit of antimony content, f. o. b. steamer, for chemical-grade ore.

Russia.—The antimony industry seems to have been untouched by the war. Antimony was mined and processed at Kadamdzhai in Osh oblast of Kirgizia and in Kazakhstan. The concentrates were smelted at the antimony-mercury combine at Frunze in Kirgizia and in a plant at Uzbekistan.

Union of South Africa.—The Consolidated Murchison mine in the Murchison Range, Transvaal, shipped 2,053 tons of antimony concentrates averaging 54 percent antimony in 1942 and operated at a rate close to 300 tons of concentrates per month in 1943. The deposits are argentiferous and auriferous and are mined principally for the gold. The concentrates assayed about 52 percent antimony, 0.59 percent arsenic, 0.09 percent nickel, 0.1 percent copper, a trace of lead, and 5 ounces of gold per ton.

Yugoslavia.—According to the December (1943) issue of Mineral Trade Notes, Podrinski Udruzani Rudnice was producing 100 to 120 metric tons of pure antimony monthly under German control. The Loznica mine was also controlled by Germany.

CADMIUM

By Allan F. Matthews

SUMMARY OUTLINE

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GENERAL STATEMENT

Cadmium was one of the few nonferrous metals to retain its critical position in 1943. In the latter half of 1943 there was a significant increase in the consumption of cadmium for bearings and chemicals and a decided decrease in cadmium consumption for electroplating, solders, and alloys. On July 26, 1943, the War Production Board issued Conservation Order M–65–a, as amended, to prohibit the use of cadmium in pigments, except for specific purposes, most of which are military. The Office of Price Administration ceiling price of 90 to 95 cents a pound remained in effect during 1943 (Schedule 71).

Salient statistics of the cadmium industry in the United States, 1939–43, in pounds

	1939	1940	1941	1942	1943
Production (primary)	4,790,500	6,363,600	7,233,500	7,370,969	8,466,963
Imports (metal)	309,874	27,491	147,378	53,298	48,891
Exports	(1)	387,118	171,858	283,630	169,265
Consumption	[2] 5,900,000	6,178,000	7,766,000	7,659,000	7,381,000
Stocks (year-end)	(1)	2,844,200	2,610,643	2,408,992	3,466,635

[1] Data not available.

[2] Apparent consumption.

DOMESTIC PRODUCTION

The production of primary cadmium surpassed the record output of 1942 by more than a million pounds, and shipments by producers advanced 16 percent. Geographic distribution of the primary cadmium production, based upon the location of plants that produced metal or compounds, was as follows in 1943: 69 percent from 4 plants in four Western States, 22 percent from 11 plants in six Central States, and 9 percent from 6 plants in four Eastern States. Domestic production is about half from domestic zinc and lead ores and about half from imported concentrates and flue dust. A decrease in production during 1944 is predicted, because a decline of smelter operations probably will follow the anticipated induction of men into the armed forces. The Corpus Christi plant of the American Smelting & Refining Co. began to produce cadmium in February 1943.

Cadmium produced and shipped in the United States, 1939–43, in pounds

	1939	1940	1941	1942	1943
Production:					
Primary: [1]					
Metallic cadmium	4,411,530	6,154,200	6,937,931	7,323,346	8,396,292
Cadmium compounds (Cd content) [2]	[3] 379,000	209,400	295,600	47,623	70,671
Total primary production	[3] 4,790,500	6,363,600	7,233,500	7,370,969	8,466,963
Secondary (metal and Cd content of compounds) [3] [4]	(3) (5)	227,900	379,500	316,345	162,424
Shipments [6] by producers:					
Primary:					
Metallic cadmium	5,190,273	6,467,260	7,044,417	7,233,043	8,326,768
Cadmium compounds (Cd content) [2]	[3] 401,200	205,900	265,700	78,059	137,952
Total primary shipments	[3] 5,591,500	6,673,200	7,310,100	7,311,102	8,464,720
Secondary (metal and Cd content of compounds) [3] [4]	(3) (5)	227,200	376,500	304,894	187,913
Value of primary shipments:					
Metallic cadmium	$2,776,224	$4,527,082	$5,498,404	$5,740,082	$6,570,546
Cadmium compounds	212,636	144,130	207,246	61,948	108,844
Total value	2,988,860	4,671,212	5,705,650	5,802,030	6,679,390

[1] Figures showing primary cadmium production for 1940–43 are strictly comparable. The data for 1939 are exactly comparable with 1940–43 as to totals, but in the former period the cadmium content of some compounds made from metal is included with the compounds and excluded from the metal.

[2] Excludes compounds made from metal.

[3] Some secondary compounds included with primary compounds; Bureau of Mines not at liberty to publish figures separately for primary cadmium compounds.

[4] Bureau of Mines not at liberty to publish figures separately for secondary cadmium compounds.

[5] Data not available.

[6] Figures for 1939 represent sales.

A large quantity of the cadmium-compound output is from metal, although some is produced directly from primary residues and secondary metal. Owing to conservation measures, the total production of cadmium compounds (in terms of Cd content) decreased 19 percent from 1942.

Cadmium compounds produced in the United States, 1941–43, in pounds

Compound	1941		1942		1943	
	Gross weight	Cd content	Gross weight	Cd content	Gross weight	Cd content
Sulfide [1]	3,304,478	1,141,500	1,001,124	300,414	671,831	227,045
Oxide [2]	410,748	361,300	594,018	519,586	511,382	447,143
Nitrate	138,951	50,600	9,710	3,546	--------	--------
Hydrate	42,995	31,500	[3] 24,207	[3] 15,821	[4] 9,995	[4] 6,129
Chloride	57,828	30,100	15,225	7,924	10,973	5,503
Carbonate	36,806	24,100	14,012	9,076	6,383	4,044
Bromide	17,041	7,000	(3)	(3)	1,844	598
Sulfate	6,771	3,400	5,442	2,584	4,790	2,354
Iodide	4,047	1,300	1,201	369	(4)	(4)
Acetate	1,300	600	948	406	1,892	832
Total production	4,020,965	1,651,400	1,665,887	859,726	1,219,090	693,648

[1] Includes cadmium lithopone and cadmium sulfoselenide.

[2] In addition to quantities shown, cadmium oxide consumed in making other compounds shown was produced as follows: 1941, 36,649 pounds (Cd content, 27,500 pounds); 1942, 38,721 pounds (Cd content 33,881 pounds); 1943, 25,975 pounds (Cd content, 22,833 pounds).

[3] Bromide included with hydrate to avoid disclosure of confidential figures.

[4] Iodide included with hydrate to avoid disclosure of confidential figures.

FOREIGN TRADE [1]

Imports.—Cadmium-metal imports from the Belgian Congo declined in 1943 compared with 1942, partly because of reduced production and also because 6,000 pounds were lost in January by enemy submarine attack. The beginning of imports from Peru was somewhat compensatory. Domestic cadmium production is partly from imported Mexican flue dust, which contained 1,643,404 pounds in 1943 compared with 1,723,728 pounds in 1942.

Exports.—Cadmium exports totaled 169,265 (153,637 of metal and 15,628 in compounds) in 1943 compared with 283,630 pounds (251,059 of metal and 32,571 in compounds) in 1942 and 171,858 pounds (65,851 of metal and 106,007 in compounds) in 1941 and 387,118 pounds (286,529 of metal and 100,589 in compounds) in 1940. The Bureau of Mines compiled these figures from exporters (except that the figures for compounds in 1943 and 1942 were estimated from data for gross weight obtained from the United States Department of Commerce); corresponding data for previous years are not available. Through Lend-Lease agreement Russia received all but an insignificant quantity of the cadmium metal exported in 1943 and 1942.

Metallic cadmium imported for consumption in the United States, 1939–43

Country	1939		1940		1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Belgian Congo							53,298	$40,363	40,355	$33,325
Belgium	197,454	$84,904	27,491	$9,520						
Canada	30,068	14,642			136,280	$139,898				
Germany	50	148								
Italy	35,304	14,847								
Netherlands	38,038	12,649								
Norway	6,720	2,822								
Peru									8,536	7,839
Poland and Danzig	2,240	961								
United Kingdom [1]					11,098	12,166				
	309,874	130,973	27,491	9,520	147,378	152,064	53,298	40,363	48,891	41,164

[1] United Kingdom of Great Britain and Northern Ireland.

CONSUMPTION AND USES

Consumption of cadmium in the United States decreased 4 percent in 1943 compared with 1942 as a result of Government conservation and stock-piling measures.

Consumption of cadmium in the United States, 1940–43, by uses

Use	1940		1941		1942		1943	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Electroplating	3,692,000	60	4,586,000	59	6,661,000	87	6,481,000	88
Bearings	1,300,000	21	1,504,000	19	282,000	4	249,000	3
Solders	73,000	1	130,000	2	201,000	3	285,000	4
Other alloys	281,000	4	221,000	3	98,000	1	198,000	2
Pigments	783,000	13	1,246,000	16	367,000	4	139,000	2
Chemicals	49,000	1	79,000	1	50,000	1	29,000	1
Total	6,178,000	100	7,766,000	100	7,659,000	100	7,381,000	100

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[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Electroplating.—Nine-tenths of the United States cadmium consumption is used to electroplate protective coatings on steel articles and parts. Of the cadmium required for this purpose in July through November 1943, according to the War Production Board, 39 percent was for aircraft frames, 17 percent for aircraft engines, 14 percent for ammunition, 6 percent for other ordnance, 10 percent for communications, 5 percent for ships, 6 percent for other military equipment, and 3 percent for civilian use. Strenuous efforts were made throughout the year to substitute coatings of zinc, lead, and other materials for cadmium plating.[2]

Alloys.—Certain bearings containing over 95 percent cadmium and small quantities of nickel, silver, and copper are made for heavy-duty applications. Of the cadmium allotted for bearings in July through November 1943, according to the War Production Board, 53 percent was for civilian use, 21 percent for ships, 8 percent for aircraft, 7 percent for ordnance, 8 percent for other military purposes, and 3 percent for export. Cadmium additions lower the melting point of solders and of fuse metal. Copper alloyed with small quantities of cadmium is fabricated into trolley wire and welding rods.

Compounds.—Cadmium sulfide and cadmium sulfoselenide are standard agents for imparting bright, resistant yellow and red, respectively, to paints, ceramics, inks, rubber, leather, and other products. Cadmium-zinc sulfide is an important phosphor for luminizing maps and aircraft dials.[3] Cadmium oxide, hydrate, and chloride are used in electroplating solutions; the fluoborate is a newcomer in this field. Cadmium carbonate is used in ceramics, and the halides in photography.

STOCKS

Total stocks of cadmium in the United States increased 48 percent over 1943 because of the advance in the Government stock pile. Stocks of metallic cadmium held by producers, compound manufacturers, and consumers declined 5, 11, and 28 percent, respectively. Distributors more than doubled their stocks, and the Government stock pile increased sevenfold over 1942.

Cadmium stocks at end of year, 1942–43, in pounds

	1942 [1]			1943		
	Metallic cadmium	Cadmium compounds (Cd content)	Total cadmium	Metallic cadmium	Cadmium compounds (Cd content)	Total cadmium
Producers	387,573	88,994	476,567	431,608	22,573	454,181
Compound manufacturers	11,595	123,777	135,372	31,059	89,913	120,972
Distributors [2]	131,443	28,310	159,753	445,328	36,529	481,857
Consumers [3]	1,283,000	83,000	1,366,000	911,000	69,000	980,000
Government	200,946		200,946	1,429,625		1,429,625
Total stocks	2,014,557	324,081	2,338,638	3,248,620	218,015	3,466,635

[1] Revised figures.
[2] Comprises principally 6 largest dealers.
[3] Partly estimated. Includes some material in process. Excludes stocks of compounds held by pigment and chemical consumers.

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[2] Soderberg, K. Gustaf, How to Conserve Our Supplies of Cadmium: Steel, vol. 113, No. 15, October 11, 1943, pp. 202-204.

[3] Stutz, G. F. A., Fluorescent and Phosphorescent Pigments: Chem. Ind., vol. 54, No. 4, April 1944, pp. 520-523.

PRICES

The Office of Price Administration ceiling price of 90 cents a pound for metallic cadmium sticks and 95 cents a pound for anode shapes prevailed throughout 1943. Shipments of metallic cadmium, as reported to the Bureau of Mines by primary producers, retained the 1942 value of 79 cents a pound in 1943 compared with 78 cents in 1941. Producers' quotations, according to E&MJ Metal and Mineral Markets, averaged 90 cents in 1943 compared with 90 cents in 1942 and 88 cents in 1941.

Prices for compounds as quoted by Oil, Paint and Drug Reporter were $1.65 to $1.91 a pound for cadmium bromide, $0.85 to $1.00 for cadmium lithopone red, 55 to 65 cents a pound for cadmium lithopone yellow, and $1.10 for cadmium sulfide.

WORLD ASPECTS

World production of cadmium in recent years, insofar as data are available, is shown in the following table.

World production of cadmium, 1938–43, by countries, in kilograms

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Australia (Tasmania)	199,326	175,150	(1)	(1)	165,821	(1)
Belgian Congo				3,086	27,387	[2] 24,000
Belgium	182,000	[3] 530,800	(1)	(1)	(1)	(1)
Canada	317,122	426,234	411,917	567,573	521,158	352,186
France	116,000	(1)	(1)	(1)	(1)	(1)
Germany	432,000	(1)	(1)	(1)	(1)	(1)
Italy	69,000	(1)	(1)	(1)	(1)	(1)
Japan	[2] 30,000	(1)	(1)	(1)	(1)	(1)
Mexico [4]	762,398	816,584	815,734	906,577	854,264	801,992
Norway	207,667	138,000	(1)	(1)	(1)	(1)
Peru					[2] 2,000	3,653
Poland	182,591	(1)	(1)	(1)	(1)	(1)
South-West Africa [4]	259,133	82,155	39,634	[5] 179,597	(1)	(1)
U. S. S. R.	[2] 50,000	(1)	(1)	(1)	(1)	(1)
United Kingdom	124,898	(1)	(1)	(1)	(1)	(1)
United States:						
Metallic cadmium	1,849,722	2,001,026	2,791,484	3,146,976	3,321,797	3,808,474
Cadmium compounds (Cd content)	98,200	171,900	95,000	134,000	21,600	32,190
	3,858,500	4,300,000	4,800,000	(1)	(1)	(1)

[1] Data not available; in 1939 and 1940, estimate included in total. [2] Estimate. [3] Exports.

[4] Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand. To avoid duplication of figures, the data are not included in the total.

[5] Figures cover January to June, inclusive.

Australia.—The United States Board of Economic Warfare in May 1943 estimated that during the year 280 metric tons of metallic cadmium would be produced by the Electrolytic Zinc Co., Risdon, Tasmania, from Broken Hill zinc concentrates (265 tons) and Port Pirie (South Australia) lead furnace baghouse fume. An additional 200 tons in Mount Isa (Queensland) fume was available for refining in Australia or the United States.

Belgian Congo.—Zinc sulfide concentrates from the Prince Leopold mine at Kipushi, southwest of Elizabethville, are roasted in Dwight-Lloyd sintering machines by Union Minière du Haut Katanga to yield sulfuric acid for the Jadotville electrolytic copper refinery. The roasting liberates part of the cadmium, which is recovered as flue dust and then refined at Jadotville by Sóciéte Générale Industrielle et Chimique du Katanga ("Sogechim"), a subsidiary. The cadmium output—at a comparatively high level in 1942–43 because of using up an accumulation of zinc dust and because of the strong demand for acid—is expected to decline to a normal level of 13 metric tons in 1944.

Belgium.—Produits Chimiques de Tessenderloo, S. A., whose plant was seriously damaged by an explosion April 29, 1942, had reestablished its electrolytic department by early 1943.[4]

Canada.—Exports of cadmium were 259,551 kilograms (572,215 pounds) in 1943 compared with 363,194 kilograms (800,710 pounds) in 1942. The output is by Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, British Columbia, and Hudson Bay Mining & Smelting Co., Flin Flon, Manitoba. Canadian metallic cadmium, ton lots, was quoted at $1.30 a pound throughout 1943, according to Canadian Metals and Metallurgical Industries.

Mexico.—Cadmium flue dust is produced at the Rosita, San Luis, and Chihuahua smelters of the American Smelting & Refining Co. and is exported for refining at the Globe plant (Denver, Colo.) of the same company. Flue dust is also recovered at the Monterrey and Torreón smelters of the American Metal Co., Ltd.

Peru.—Cadmium production was begun early in 1942 by the Cerro de Pasco Copper Corporation at Oroya.

Spain.—Production of about 500 kilograms of cadmium annually is planned by the Real Compañía Asturiana de Minas—the principal zinc producer—whose ores in the Santander region contain 0.15 percent Cd.

United Kingdom.—Cadmium requirements of the war industries are met by imports from the Dominions—Canada and Australia. Consumption for plating has been severely restricted, and the larger part of the available supply now goes into alloys.[5] This use trend parallels that of Germany but is opposite to that of the United States. The Minister of Supply imposed license control on cadmium sales, effective January 1, 1942, and at the same time established a ceiling price for ingots, sticks, and rods at 5 s. 4 d. a pound in hundredweight lots.

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[4] Chemical Age (London), vol. 48, No. 1235, February 27, 1943, p. 251.

[5] Metal Bulletin (London), No. 2752, December 15, 1942, p. 10.

PLATINUM AND ALLIED METALS

By H. W. Davis

SUMMARY OUTLINE

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SUMMARY

Despite prohibitions and limitations on the use of platinum metals for certain purposes, consumption (as measured by sales—509,232 ounces) in 1943 surpassed the record established in 1942 by 36 percent. The increase was due mainly to the larger demand for platinum for electronic tubes, contact points, and spinnerets for glass fiber, and for palladium in jewelry. Imports of platinum metals (362,251 ounces) also exceeded the high of 1942 by 15 percent. Refining of platinum metals not only did not pace consumption but dropped 8 percent below the all-time peak of 1942.

Salient statistics of platinum and allied metals in the United States, 1942–43, in troy ounces

	1942	1943
Production:		
Crude platinum from placers	23,213	[1] 27,162
New metals:		
Platinum	244,226	234,320
Palladium	140,262	82,441
Other	15,839	18,495
	400,327	335,256
Secondary metals:		
Platinum	56,150	68,613
Palladium	16,416	23,616
Other	4,045	9,352
	76,611	101,581
Stocks in hands of refiners, importers, and dealers, Dec. 31:		
Platinum	160,724	176,560
Palladium	107,383	104,372
Other	35,280	42,081
	303,387	323,013
Imports for consumption:		
Unrefined materials	263,652	263,968
Refined metals	51,350	98,283
	315,002	362,251
Exports:		
Ore and concentrates	159	84
Refined metals and alloys, including scrap	102,461	1,381
Manufactures (except jewelry)	1,246	1,802

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[1] Subject to revision.

Figure 1 shows graphically the trend in world production of platinum metals from 1914 to 1942.

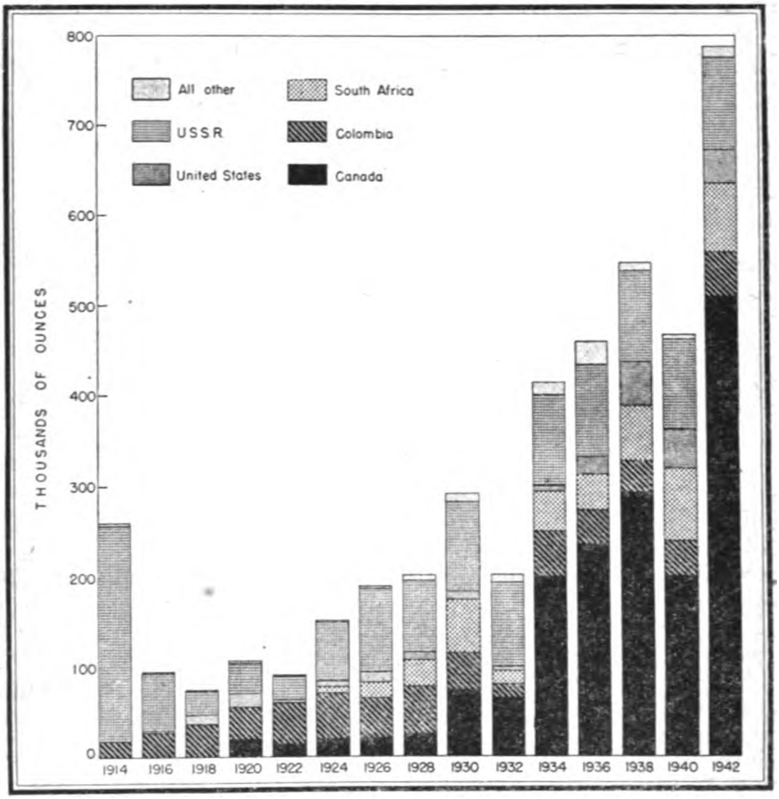

FIGURE 1.—Trend in world production of platinum metals, 1914–42.

POST-WAR OUTLOOK

The war has emphasized the importance and versatility of the platinum metals but has developed few new uses for them. Although consumption will decline substantially when the war ends, with stability in the price of the platinum metals that will permit their use for industrial purposes, coupled with developmental activities in opening up larger and more diversified markets, a post-war demand considerably greater than during the immediate pre-war years should result.

WAR REGULATIONS

The War Production Board issued a number of regulations on platinum metals in 1943. Conservation Order M–302, issued April 16, provides that osmium and osmium alloy processed after that date shall be used for implements of war only. Order M–49, as amended April 30, places iridium under complete allocation and confines its use to contact points, fuse wire for detonators, electrical primers, and laboratory ware. Order L–45, effective April 15, restricted the use of gold and palladium by large manufacturers in their production of jewelry, from April 15 through June 30, to 75 percent of their use of these metals during the same period of 1941; since July 1 the reduction has been 50 percent. Restrictions on jewelry output as provided for in Order L-45 are intended to release plant facilities and workers for war production and do not result from shortage of palladium or gold. Order M-162, as amended November 22, places restrictions on the sale and delivery of platinum scrap, prohibits delivery of platinum to processors having more than a specified amount of scrap, and limits processors' and consumers' inventories of platinum.

Maximum prices for the platinum metals were established by the Office of Price Administration in Maximum Price Regulation 309.

CRUDE PLATINUM

Production.—Mine returns for 1943 indicate a production of 27,100 ounces of crude platinum (containing 23,900 ounces of platinum-group metals) in Alaska[1] and 62 ounces in California—a total of 27,162 ounces; comparable figures for 1942 are 22,000 ounces of crude platinum (containing 19,360 ounces of platinum-group metals) in Alaska, 1,200 ounces in California, and 13 ounces in Oregon—a total of 23,213 ounces. Production in Alaska came mainly from placer deposits in the Goodnews district of southwestern Alaska; most of it was mined by a large modern dredge and by well-mechanized draglines. In California the output of platinum was a byproduct of dredges working gold placers in Yuba County. There was no production in Oregon in 1943.

Many gold and copper ores in the United States contain small quantities of platinum metals. In 1943, 10,390 ounces of platinum metals were recovered as a byproduct of refining gold and copper ores compared with 9,805 ounces in 1942.

Purchases.—Buyers in the United States reported purchases of domestic crude platinum from the following sources in 1943: Alaska, 27,011 ounces; California, 1,114 ounces; and Oregon, 5 ounces—a total of 28,130 ounces (23,147 ounces in 1942). Domestic buyers also reported purchases of 39,409 ounces (53,661 ounces in 1942) of foreign crude platinum or osmiridium in 1943—15 ounces from Australia and 39,394 ounces from Colombia.

Prices.—Buyers reported purchases at $41.08 to $61.15 an ounce for domestic crude platinum and $26.69 to $90.10 an ounce for foreign crude platinum or osmiridium in 1943.

REFINED PLATINUM METALS

New metals recovered.—Reports from refiners of crude platinum, gold bullion, nickel, and copper indicate that 335,256 ounces of platinum metals were recovered in the United States from such sources in 1943, a decrease of 16 percent from the all-time record established in 1942. Of the new metals recovered in 1943, 90 percent was chiefly from concentrates from Canada and crude from Colombia, 7 percent from domestic crude (chiefly from Alaska), and 3 percent a byproduct of domestic gold and copper ores.

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[1] Figures and other information for Alaska from Geological Survey, U. S. Department of Interior. Figures for 1943 subject to revision.

New platinum metals recovered by refiners in the United States in 1943, by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total
Domestic from—							
Crude platinum	21, 510	151	1, 932	508	265	161	24, 527
Gold and copper refining	5, 205	5, 105	47	5	20	8	10, 390
	26, 715	5, 256	1, 979	513	285	169	34, 917
Foreign from—							
Crude platinum	207, 605	77, 185	3, 307	680	6, 846	4, 716	300, 339
Nickel and copper refining							
Total recovery	234, 320	82, 441	5, 286	1, 193	7, 131	4, 885	335, 256

New platinum metals recovered by refiners in the United States, 1939–43, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1939	36, 033	3, 491	1, 051	866	41, 441
1940	38, 951	4, 564	1, 517	2, 307	47, 339
1941	98, 376	49, 812	1, 392	3, 043	152, 623
1942	244, 226	140, 262	5, 102	10, 737	400, 327
1943	234, 320	82, 441	5, 286	13, 209	335, 256

Secondary metals recovered.—In 1943, 101,581 ounces of secondary platinum metals were recovered from the treatment of scrap metal, sweeps, and other waste products of manufacture that contain platinum metals—a 33-percent increase over 1942.

Substantial quantities of worn-out catalysts, spinnerets, laboratory ware, and other products are returned by consumers to refiners for refining. The refined platinum metals recovered from these products (or their equivalent in refined metals) are returned to the consumers. The platinum metals so recovered are not included in the figures of secondary metals.

Secondary platinum metals recovered in the United States, 1939–43, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1939	45, 432	13, 039	2, 767	2, 205	63, 443
1940	47, 657	14, 773	1, 365	2, 635	66, 430
1941	37, 522	12, 630	659	758	51, 569
1942	56, 150	16, 416	1, 552	2, 493	76, 611
1943	68, 613	23, 616	2, 771	6, 581	101, 581

Prices.—Maximum prices for the six platinum metals were established by the Office of Price Administration in Maximum Price Regulation 309, effective February 1, 1943. The maximum prices per troy ounce for refined metals of a commercial purity of at least 99.5 percent were as follows: Platinum, $35; palladium, $24; iridium, $165; osmium, $50; rhodium, $125; and ruthenium, $35. Maximum prices for metals of less than 99.5 percent purity and for the platinum metals content of scrap, sweeps, and other waste products shall not exceed the highest net price the seller had in effect during the first quarter of 1942.

Properties and uses.—Much information on the platinum metals and their alloys, particularly their physical and mechanical properties and their many and diverse uses, is given in the excellent book, The Platinum Metals and Their Alloys, published in 1941 by the International Nickel Co., Inc., New York, N. Y. With slight changes and additions the following table on uses has been taken from this publication.

Uses of the platinum metals

Use	Pt	Pt Ir	Pt Rh	Pt Ru	Pd	Pd Ru	Pd Au	Pd Ag	Other platinum metals, alloys, or materials
Electrical and physical:									
Contacts for communication and other relays, magnetos, thermostats, voltage regulators, and control devices.	x	x	x	x	x			x	PtAg; WC+Pt or Os; PtAuAg; PdCu; OsIrRu; etc.
Spark-plug electrodes	x	x	x						
Resistors	x	x			x			x	
Furnace-heating resistors	x		x						Rh.
Resistance thermometers	x								
Thermocouples	x		x				x		
Temperature-limiting fuses							x		PtPdAu.
Overload electrical fuses	x	x							
Detonator fuses		x							
Thermionic cathodes									PtNi.
Metal-to-glass seals	x								"Liquid" Pt.
Reflectors									Rh.
Light filters									Rh or Pt films.
Electronic tubes									PtW.
Chemical:									
Corrosion-resistant equipment, solid or clad.	x	x	x				x		
Crucibles	x	x	x						
Safety (bursting or frangible) disks	x	x							
Anodes for "per salts", halogens, organic oxidations, electroplating, and electroanalysis.	x	x	x						
Cathodes for electroanalysis	x	x							
Spinnerets for rayon			x				x		PtAu; PtPdAu.
Surfaced-glass joints to prevent sticking.									"Liquid" Pt.
Feeder dies for glass lamp bases and spinnerets for glass fiber.	x		x						PtIrNi.
Crucibles for oxide fusions, including glass, and synthetic crystals for optical parts.	x	x	x						Ir.
Burner nozzles	x	x							
Gas meters and orifices	x	x	x						
Catalysts:									
Oxidation of ammonia for nitric acid production.			x						
Oxidation of sulfur dioxide for sulfuric acid production.	x								
Automatic gas lighters and flameless cigarette lighters.	x								
Hydrogenation of numerous organic compounds.	x				x				Ru.
Dehydrogenation of numerous organic compounds.	x				x				
Dental:									
Casting alloys		x							PtPdAuAgCu.
Wrought alloys	x	x			x		x	x	PtPdAuAgCu; PdRhRu; PdPtAg.
Tooth pins and anchorages		x			x		x	x	PdPtAuAg; PdPtAu; PdAuAg.
Porcelain matrices	x								
Reinforcement for dental porcelain	x	x							
Jewelry and decorative:									
Diamond and other gem mountings		x		x		x			PdRuRh.
Ring blanks	x	x				x			PdRuRh.
Decoration in conjunction with gold	x	x		x		x		x	PdRuRh; PdPtAg.
Spectacle frames	x	x		x		x		x	PdPtAg.
Watch cases		x		x		x		x	PdRuRh; PdPtAg.
Nontarnishing leaf for signs, bookbinding, leather goods, etc.	x				x				
Metallized glass and ceramic ware									"Liquid" Pt.
Medals, trophies, objects of art, etc	x	x		x	x	x			PdRuRh.
Electroplates	x				x				Rh.
Platinum solders							x		PtPdAuAg; also Au.
Miscellaneous:									
Hydrogen purification by diffusion					x				
Photographic papers	x				x				
Color responsive carbon monoxide detectors.									Pd chloride.
Finger-print detection and biological stain.									Ru or Os compounds.
Grain refiners for gold and silver base dental alloys.									IrRu.
Tips for fountain pens and phonograph needles.									RuOs with Ir, Pt, W, Co, or Ni.
Pivot points									RuOs with other materials.

Abbreviations: Pt, platinum; Pd, palladium; Ir, iridium; Os, osmium; Rh, rhodium; Ru, ruthenium; Au, gold; Ag, silver; WC, tungsten carbide; Cu, copper; Ni, nickel; W, tungsten; Co, cobalt.

Consumption.—As pure metals, combined, clad, or alloyed with other metals, the platinum metals are employed in the electrical and chemical industries, in dentistry and jewelry, and for numerous miscellaneous purposes. Sales to consumers in the United States were 509,232 ounces in 1943 compared with 375,812 ounces in 1942.

The most widely used metal of the group is platinum, which constituted 344,719 ounces (68 percent) of the total platinum metals sold to consumers in the United States in 1943. The electrical industry, which was a close second to the chemical industry as the chief consumer of platinum in 1942, advanced to first place in 1943 by taking 185,281 ounces (54 percent) of the total platinum sold. The largest outlets for platinum in the electrical industry were for magneto and other contacts and electronic tubes. The chemical industry dropped to second place as a consumer of platinum but accounted for 131,716 ounces (38 percent) of the total sales. The largest outlets for platinum in the chemical industry were as catalysts to produce nitric and sulfuric acids, as spinnerets for glass fiber and rayon, and in laboratory ware. Sales of platinum to the dental industry increased phenomenally and accounted for 27,044 ounces (8 percent) of the total sold. Because of the ban on platinum in jewelry, sales declined to 438 ounces in 1943 (66,518 in 1942).

Next to platinum, palladium is the most extensively used metal of the group; it constituted 137,709 ounces (27 percent) of the total platinum metals sold to domestic consumers in 1943. The jewelry industry—the third largest consumer in 1942—ascended to first place in 1943 and took 45,218 ounces (33 percent) of the total palladium sold. Sales of palladium to the jewelry industry increased 130 percent. The dental industry was the second largest outlet for palladium in 1943, taking 41,522 ounces (30 percent) of the total sold. The electrical industry dropped from first to third place as a consumer of palladium in 1943; it accounted for 25,907 ounces (19 percent) of the total sold. Sales of palladium to the chemical industry gained 158 percent in 1943.

The consumption of the other platinum metals—iridium, rhodium, osmium, and ruthenium—is comparatively small; it made up 5 percent (26,804 ounces) of the total for the group in 1943. Ruthenium and iridium were the most extensively used metals of this group, followed in order by rhodium and osmium. Sales of ruthenium and iridium were 44 and 24 percent, respectively, greater than in 1942, but those of rhodium and osmium declined 38 and 5 percent, respectively.

The following table shows sales of platinum metals by refiners, importers, dealers, and Metals Reserve Co. to consumers in the United States in 1943.

Platinum metals sold to consuming industries in the United States in 1943, in troy ounces

Industry	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
Chemical	131,716	14,162	4,154	150,032
Electrical	185,281	25,907	15,851	227,039
Dental	27,044	41,522	160	68,726
Jewelry	438	45,218	2,080	47,736
Miscellaneous and undistributed	240	10,900	4,559	15,699
	344,719	137,709	26,804	509,232

Stocks.—Stocks of platinum metals in all forms in the hands of refiners, importers, and dealers totaled 323,013 ounces on December 31, 1943, compared with 303,387 ounces at the close of 1942.

Stocks of platinum metals held by refiners [1] in the United States, December 31, 1939–43, in troy ounces

Year	Platinum	Palladium	Iridium	Osmium, rhodium, and ruthenium	Total
1939	71,393	29,273	7,000	9,884	117,550
1940 [1]	144,302	93,244	32,368		269,914
1941 [1]	150,887	138,014	33,942		322,843
1942 [1]	160,724	107,383	35,280		303,387
1943 [1]	176,560	104,372	42,081		323,013

[1] In 1940 figures also include stocks held in the United States by importers from the United Kingdom; in 1941, 1942, and 1943 figures also include stocks held in the United States by all importers and dealers.

FOREIGN TRADE [2]

Imports.—Imports of platinum metals into the United States increased for the third successive year to establish a new high; they were 15 percent greater than in 1942, the previous record year. The principal sources of imported platinum metals in 1943 were Canada (263,607 ounces), U. S. S. R. (41,272 ounces), and Colombia (38,232 ounces). Imports of unrefined materials (263,968 ounces) were virtually the same in 1943 as in 1942, but imports of refined metals increased to 98,283 ounces (51,350 ounces in 1942). Imports of palladium, osmium, and ruthenium were about 4½, 2½, and 3 times, respectively, those of 1942, but imports of rhodium were only one-tenth as much.

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[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Platinum metals (unmanufactured) imported for consumption in the United States, 1942–43

Material	1942		1943	
	Troy ounces	Value	Troy ounces	Value
Unrefined materials: [1]				
Ores and concentrates of platinum metals	181, 271	$6, 897, 495	92, 709	$2, 829, 164
Grains and nuggets (including crude, dust, and residues)	68, 187	2, 006, 500	98, 401	2, 884, 542
Sponge and scrap	13, 918	341, 316	72, 783	2, 218, 706
Osmiridium	276	23, 367	75	5, 054
	263, 652	9, 268, 678	263, 968	7, 937, 466
Refined metals:				
Platinum	32, 254	1, 193, 183	41, 272	1, 545, 975
Palladium	9, 984	190, 892	43, 874	932, 392
Iridium	884	102, 848	1, 056	133, 342
Osmium	475	20, 764	1, 161	47, 386
Rhodium	4, 249	440, 599	405	45, 989
Ruthenium	3, 504	89, 601	10, 515	293, 693
	51, 350	2, 037, 887	98, 283	2, 998, 777
	315, 002	11, 306, 565	362, 251	10, 936, 243

[1] The concentrates and crude imported from Canada contain platinum, palladium, iridium, rhodium, and ruthenium, and the crude sponge imported from Canada contains platinum and palladium. Although the U. S. Department of Commerce records "platinum content" for these entries, the Bureau of Mines has determined from the importers of these materials that most of the entries reflect the platinum metals content. The Bureau of Mines has also determined from the largest importer of crude platinum from Colombia that the entries for his material, recorded as "platinum content" by the U. S. Department of Commerce, represent the gross weight of the material.

Platinum metals (unmanufactured) imported for consumption in the United States, 1942–43, by countries, in troy ounces

Country	Unrefined materials [1]				Refined metals					
	Ores and concentrates of platinum metals	Grains and nuggets (including crude, dust, and residues)	Sponge and scrap	Osmiridium	Platinum	Palladium	Iridium	Osmium	Rhodium and ruthenium	Total
1942										
Canada	167, 647	20, 175	13, 838	41	16	2	399		2, 914	205, 032
Colombia		46, 711	3							46, 714
United Kingdom	13, 624	1, 295	4	80		9, 484	485	475	4, 830	30, 277
U. S. S. R					32, 226					32, 226
Other countries		6	73	155	12	498	([2])		9	753
	181, 271	68, 187	13, 918	276	32, 254	9, 984	884	475	7, 753	315, 002
1943										
Canada	92, 709	60, 169	72, 686		([2])	32, 137	([2])	11	5, 895	263, 607
Colombia		38, 232								38, 232
United Kingdom				61		11, 737	1, 056	1, 150	5, 025	19, 029
U. S. S. R					41, 272					41, 272
Other countries			97	14						111
	92, 709	98, 401	72, 783	75	41, 272	43, 874	1, 056	1, 161	10, 920	362, 251

[1] See footnote [1] of preceding table.

[2] Less than 1 ounce.

Platinum metals imported for consumption in the United States, 1939–43

Year	Troy ounces	Value	Year	Troy ounces	Value
1939	306, 627	$9, 881, 531	1942	[1] 315, 002	[1] $11,306,565
1940	[1] 195, 645	[1] 5, 748, 005	1943	[1] 362, 251	[1] 10,936,243
1941	[1] 309, 995	[1] 7, 143, 612			

[1] See footnote [1] of preceding table.

Exports.—Exports of refined platinum metals and alloys (including scrap) decreased to 1,381 ounces in 1943 from 102,461 ounces in 1942; however, the 1942 exports included 97,800 ounces of refined palladium, which were shipped to Canada for storage. Canada and Brazil were the chief foreign markets for platinum metals in 1943.

Platinum and allied metals exported from the United States, 1939–43

Year	Ore and concentrates		Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1939	(1)	(1)	[2] 46,329	[2] $1,528,563	(2)	(2)	4,041	$213,445
1940	(1)	(1)	[2] 55,027	[2] 2,280,339	(2)	(2)	1,800	96,703
1941	244	$11,713	[2] 15,405	[2] 607,333	(2)	(2)	3,204	160,674
1942	159	6,581	3,354	126,007	99,107	$2,301,953	1,246	61,088
1943	84	3,642	860	43,961	521	28,264	1,802	70,226

[1] Not separately classified.
[2] Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium included with platinum; not separately classified before 1942.

Platinum and allied metals exported from the United States in 1942–43, by countries

Country	Ore and concentrates		Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1942								
Argentina	....	....	331	$13,685	462	$13,728	78	$5,107
Brazil	46	$1,573	290	10,884	93	2,912	126	9,896
Canada	....	....	1,733	73,148	98,377	2,279,737	640	24,147
Chile	....	....	234	9,291	57	2,648	80	4,311
Netherlands Indies	....	....	321	11,413	....	....	2	79
Other countries	113	5,008	445	7,586	118	2,928	320	17,548
	159	6,581	3,354	126,007	99,107	2,301,953	1,246	61,088
1943								
Argentina	....	....	113	4,902	....	....	....	....
Australia	....	....	....	....	84	2,061	17	825
Brazil	71	3,246	115	4,511	12	610	40	691
Canada	4	74	467	26,016	166	16,447	1,341	56,890
Chile	....	....	6	269	....	1,613	27	1,086
Cuba	9	322	35	1,144	116	2,792	17	380
Palestine and Trans-Jordan	....	....	....	....	80	2,772	20	693
Other countries	....	....	124	7,119	63	1,969	340	9,661
	84	3,642	860	43,961	521	28,264	1,802	70,226

WORLD PRODUCTION

Because of restriction on the publication of statistics by certain governments, figures for many countries have not been available since 1939.

World production of platinum and allied metals, 1937–43, in troy ounces

[Compiled by B. B. Waldbauer]

Country and product	1937	1938	1939	1940	1941	1942	1943
Australia:							
New South Wales: Placer platinum	46	8	(1)	(1)	(1)	(1)	(1)
Tasmania: Placer osmiridium	586	191	283	(1)	(1)	(1)	(1)
Belgian Congo: From refineries:							
Palladium	12,507	1,575	3,312	(1)	(1)	(1)	(1)
Platinum	2,122	225	868	(1)	(1)	(1)	(1)
Canada:							
Placer platinum	22	16	25	24	60	30	(1)
From refineries: [2]							
Platinum	139,355	161,310	148,877	108,464	124,257	298,400	(1)
Other platinum metals	119,829	130,893	135,402	91,522	97,432	226,600	(1)
Colombia: Placer platinum (exports)	29,315	34,549	39,070	35,859	37,349	49,163	39,961
Ethiopia: Placer platinum	3,376	3,537	(1)	(1)	(1)	(1)	(1)
Italy: From refineries: Platinum	1,286	1,029	(1)	(1)	(1)	(1)	(1)
Japan: Placer platinum	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Netherlands Indies (probably placer platinum)	--------	21	28	34	(1)	(1)	(1)
New Zealand: Placer platinum	55	1	13	--------	35	21	(1)
Panama: Placer platinum	267	--------	--------	--------	(1)	(1)	(1)
Papua: [3]							
Placer platinum	20	41	2	(1)	(1)	(1)	(1)
Placer osmiridium	8	4	4	(1)	(1)	(1)	(1)
Sierra Leone: Placer platinum	308	180	83	135	(1)	(1)	(1)
Union of South Africa:							
Platinum (content of platinum metals) [4]	17,776	18,256	18,068	20,140	16,580	20,050	[5] 13,328
Concentrates (content of platinum metals) [4]	21,849	35,124	41,243	51,835	69,150	53,160	[5] 36,033
Osmiridium [6]	5,790	5,354	7,031	(1)	(1)	(1)	(1)
U. S. S. R.: Placer platinum [7]	100,000	100,000	100,000	100,000	100,000	100,000	100,000
United States:							
Placer platinum	10,803	40,932	32,460	33,800	26,221	23,213	[8] 27,162
Ore (content of platinum metals)	124	90	66	--------	15	26	--------
From refineries: [9]							
Platinum	4,761	3,761	5,270	4,470	1,805	4,333	5,205
Other platinum metals	5,817	3,486	3,364	3,304	4,689	5,472	5,185
Total [7]	476,000	541,000	540,000	465,000	483,000	790,000	(1)

[1] Data not available.
[2] Recovered from nickel-copper mattes.
[3] Year ended June 30 of year stated.
[4] Produced from platinum ores.
[5] January to September, inclusive.
[6] Produced from treatment of gold ores on the Rand.
[7] Estimate.
[8] Subject to revision.
[9] New platinum metals recovered in gold and copper refining of domestic materials.

Canada.—Although the Bureau of Mines is not at liberty to publish figures on the recovery of platinum metals from the nickel-copper ores of the Sudbury district, Ontario, in 1943, it can be stated that the output was substantially less than the all-time high in 1942, which was 298,400 ounces of platinum and 226,600 ounces of other platinum-group metals.

Colombia.—Colombia exported 39,961 ounces of crude platinum in 1943 (49,163 in 1942). The South American Gold & Platinum Co. produced 23,945 ounces of crude platinum metals in 1943 (25,786 in 1942) and 55,446 ounces of gold (51,974 in 1942). The figures for other operators are not available.

TITANIUM

By Allan F. Matthews

SUMMARY OUTLINE

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GENERAL STATEMENT

Development of titanium mining on a substantial scale in the United States during 1943 nearly tripled production and supplied fully two-thirds of the domestic ilmenite consumed and one-fourth of the rutile. Imports of ilmenite did not quite fill the supply-demand gap, so stocks were reduced one-fourth. Rutile entries, on the other hand, were ample to maintain stocks, even in the face of increased consumption. Titanium prices were unchanged during 1943.

Post-war demand is expected to be double pre-war consumption, principally because titanium provides a superior white pigment but partly because it is the most abundant ferro-alloy metal and is a standard requirement of the expanded welding-rod industry. The United States probably will achieve self-sufficiency in ilmenite during the latter half of 1944. Largely responsible for that position is the New York ilmenite mine, which is expected to continue operation after the war, although possibly at a reduced rate if it again becomes more economical to import ore from India and other foreign sources.

Creation of a titanium pigment cartel in conspiracy with German, British, Italian, Japanese, and other foreign interests in violation of the Antitrust Act was charged by the Department of Justice in a Federal grand jury indictment in New York City June 28, 1943, and before the War Mobilization Subcommittee, Senate Military Affairs Committee, November 4. E. I. du Pont de Nemours & Co., Inc., the National Lead Co., and several foreign firms were charged with division of the world market into noncompetitive areas, international patent transfers to avoid seizure as enemy property, exorbitant prices, and monopolistic control of the industry in the United States. Replying to the charges, Fletcher W. Rockwell, president of the National Lead Co., stated that they referred to transactions considered legal and proper at the time they were made; he called upon the Government to formulate a policy on the conduct of international business.

DOMESTIC PRODUCTION

Ilmenite production in the United States nearly tripled in 1943 compared with 1942, and rutile output increased 51 percent. Ilmenite concentrates shipped in 1943 contained 44 to 60 percent TiO_2, and rutile concentrates ranged from 90 to 94 percent TiO_2.

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1939–43

Year	Ilmenite				Rutile			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Gross weight (short tons)	TiO_2 content (short tons)	Value		Gross weight (short tons)	TiO_2 content (short tons)	Value
1939	14,602	16,872	7,668	$137,042	(1)	(1)	(1)	(1)
1940	20,668	20,702	9,505	183,686	2,888	2,657	2,475	$393.243
1941	23,297	21,526	9,930	196,522	3,130	3,431	3,192	493,782
1942	77,208	93,397	41,328	1,805,823	2,648	2,649	2,466	410,956
1943	203,551	211,715	94,283	3,738,970	3,987	3,941	3,639	610,879

[1] Bureau of Mines not at liberty to publish figures.

Arkansas.—The Titanium Alloy Co. of Arkansas, Inc., subsidiary of Titanium Alloy Manufacturing Co., sold its rutile property at Malvern, Magnet Cove district, Hot Spring County, to the Magnet Cove Rutile Co. early in December 1943. During 21 months of operation the former owner produced 580 short tons of rutile (largely from a stock pile of crude concentrates averaging 52 percent TiO_2 purchased with the property) and shipped 625 tons (45 from stock) averaging 90 percent TiO_2 and valued at $79,500.

Florida.—Riz Mineral Co. operates a concentrator at Melbourne, Brevard County, for the production of rutile, ilmenite, and zircon. The ore feed is sand—formerly from stretches of beaches in the vicinity of Melbourne but now from dunes some 3 miles inland from Vero Beach, Indian River County. In August 1943 Rutile Mining Co. of Florida, subsidiary of Titanium Alloy Manufacturing Co., began to produce rutile and ilmenite from sand dunes about midway between Jacksonville, Duval County, and the Atlantic coast. This company signed a contract with Government-owned Metals Reserve Co. to deliver 2,900 short tons of rutile between June 1943 and April 1944. St. Johns River Lumber & Development Co., St. Augustine, St. Johns County, shipped a small quantity of mixed ilmenite-rutile-zircon concentrate in 1943. In Duval and St. Johns County near Ponte Vedra is a 17-mile beach property which was worked for ilmenite, rutile, zircon, and monazite in 1916–27 by Buckman & Pritchard, Inc., a subsidiary of the National Lead Co. after 1922. Depletion of the best ore and availability of larger and cheaper quantities of ilmenite from abroad led to discontinuance of mining, and the subsidiary (renamed the Ponte Vedra Co.) developed the property residentially and sold it in December 1942.[1] Beach deposits in Santa Rosa, Escambia, and Okaloosa Counties near Pensacola are estimated to contain 750,000 tons of material averaging 1.2 percent kyanite, 1.0 percent ilmenite, 0.4 percent zircon, and 0.1 percent rutile.

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[1] National Lead Co., 51st Annual Report for Fiscal Year Ended December 31, 1942, pp. 4–5.

New York.—The National Lead Co., Tahawus, Essex County, in 1943 mined 985,261 short tons of ore (16 percent TiO_2 and 33 percent Fe) and concentrated 983,759 tons, which yielded 165,612 tons of ilmenite (165,198 tons were shipped) averaging 44 percent TiO_2 and 398,713 tons of magnetite averaging 56 percent Fe. Shortage of labor and a bottleneck in the crushing plant prevented reaching the goal of 900 short tons of ilmenite daily, a level now expected by mid-1944. Five months operation in 1942 yielded a production of 45,395 short tons of ilmenite and shipments of 43,923 tons. Production technology at the property was described.[2] Ore reserves are estimated at 43 million tons.[3]

North Carolina.—Ilmenite concentrates averaging 50 percent TiO_2 are produced at Finley, Caldwell County, by the Yadkin Valley Ilmenite Co., subsidiary of the Glidden Co. The current output of about 40 tons daily is utilized by the American Zirconium Corporation, St. Helena, Baltimore, Md. (an affiliated company), to make titanium pigments. It is planned as soon as equipment is available to expand the Yadkin Valley operations to possibly 100 tons daily of ilmenite, some of which would be available for sale.

Oregon.—Although chromite was recovered in 1943 from marine black sands of Coos County, the expected ilmenite byproduct did not materialize.

Texas.—A deposit in Jeff Davis County[4] contains a fine-grained rutile disseminated in hard, silicified tuff that can be concentrated to 87 percent TiO_2 with a recovery of 67 percent.[5]

Virginia.—The American Rutile Corporation, subsidiary of the Metal & Thermit Corporation, produces rutile and ilmenite near Roseland, Nelson County. Southern Mineral Products Corporation, subsidiary of the Vanadium Corporation of America, sold its ilmenite property in the same district to Virginia Chemical Corporation, subsidiary of Interchemical Corporation, December 1943.

FOREIGN TRADE[6]

Imports.—Ilmenite imports in 1943 recovered from the slump of 1942, largely as a result of substantially larger shipments from Canada. Receipts from India continued to be small, partly owing to the shortage of barges to move the concentrates from the mines to a point of export. Rutile imports continued to climb in 1943. Australia supplied most of the increase, but Brazil's important contribution was maintained at its 1942 level. Cameroun is becoming a significant source of rutile. Titanium is imported from Australia only in the form of mixed zircon-rutile-ilmenite concentrates, which are separated into their component minerals by the International Titanium Corporation (subsidiary of the American Rutile Corporation and Ventures, Ltd.), Carteret, N. J.; Orefraction, Inc., Pittsburgh, Pa.; and Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. There were no imports of ferrotitanium in 1941–43.

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[2] Herres, Otto, and staff, MacIntyre Development of National Lead Co. at Tahawus, N. Y.: Min. and Met., vol. 24, No. 443, November 1943, pp. 509-516.

[3] Balsley, James R., Jr., Vanadium-Bearing Magnetite-Ilmenite Deposits near Lake Sanford, Essex County, N. Y.: Geol. Survey Bull. 940-D, 1943, pp. 99-123, 5 plates.

[4] Vogel, Felix A., Jr., Preliminary Report on the Rutile and Kaolin Deposits of the Medley District in Jeff Davis County, Tex.: W. P. A. Statewide Mineral Resources Survey Project, Univ. of Texas Mineral Resources Surv. Circ. 53, August 1942, 8 pp., 4 maps.

[5] Engel, A. L., and Shelton, S. M., Progress Reports—Metallurgical Division. 52. Ore-Testing Studies of the Ore-Dressing Section, Fiscal Year 1941: Bureau of Mines Rept. of Investigations 3628, pp. 32-33.

[6] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Titanium concentrates[1] *imported for consumption in the United States, 1939–43, by countries, in short tons*

Country of origin	1939	1940	1941	1942	1943
ILMENITE					
Australia[2]	28	2	364	235	390
Brazil		2	3,709	1,287	
Canada			5,725	4,540	65,437
India and Dependencies	286,548	221,637	156,079	1,165	8,960
Portugal			969		
Total as reported	286,576	221,641	166,846	7,227	74,787
Australia: In "zirconium ore"[2]	615	2,250	3,843	3,180	3,306
Grand total	287,191	223,891	170,689	10,407	78,093
Value of "As reported"	$1,126,200	$750,590	$629,940	$60,490	$380,161
RUTILE					
Australia[2]	343	22	666	1,311	2,802
Brazil	99	128	2,448	4,966	4,920
Cameroun (French)[3]				146	1,095
India and Dependencies					818
Portugal		6			
Total as reported	442	156	3,114	6,423	9,635
Australia: In "zirconium ore"[2]	345	2,008	3,177	4,102	4,703
Grand total	787	2,164	6,291	10,525	14,338
Value of "As reported"	$23,170	$14,849	$306,176	$623,917	$823,624

[1] Classified as "ore" by the United States Department of Commerce.

[2] All imports of titanium from Australia in 1939–43 were in mixed zircon-rutile-ilmenite concentrates. Totals of mixed concentrates are derived by addition of the United States Department of Commerce figures for imports of ilmenite, rutile, and "zirconium ore" from Australia. These totals are divided by the Bureau of Mines (on the basis of surveys of importers) into the three component minerals. The excess quantities of ilmenite and rutile over the quantities reported by the United States Department of Commerce in those specific categories are entered as "In 'zirconium ore.'"

[3] Includes quantities reported by the United States Department of Commerce as originating in French Equatorial Africa, from which no rutile production has been recorded.

Exports.—Titanium products valued at 2¼ million dollars were exported in 1943. Most of the concentrates (probably rutile) and alloys went to Canada. Of the pigments, 86 percent went to Canada, and 7 percent was divided about equally between Argentina and Brazil. The quantity of tetrachloride exported was 694 tons—43 percent to United Kingdom, 27 percent to Egypt, 18 percent to India, 11 percent to Algeria, and 1 percent to other countries.

Exports of titanium products from the United States, 1939–43, by classes

Year	Concentrates		Metal and alloys (including ferro-alloys)		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	(1)	(1)	(1)	(1)	4,319	$698,063	(1)	(1)
1940	(1)	(1)	(1)	(1)	4,962	867,535	(1)	(1)
1941	[2] 432	[2] $70,613	[2] 150	[2] $35,687	7,821	1,609,071	[3] 17	[3] $5,792
1942	618	117,886	461	60,938	8,870	1,707,433	24	13,666
1943	576	103,947	760	117,402	9,765	1,830,344	728	442,591

[1] Data not available.

[2] Data cover last 6 months only.

[3] Data cover last 4 months only.

STOCKS

Ilmenite stocks continued to decline during 1943, but they constituted a 5 months' supply, even at the end of the year. Rutile stocks were little changed.

Stocks of titanium concentrates in the United States at end of year, 1942–43, in short tons

Stocks	1942				1943			
	Ilmenite		Rutile[1]		Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
Mine	11,917	5,142	54	50	3,753	1,771	100	94
Distributors[2]	11,541	5,371	1,778	1,653	7,808	3,514	949	883
Consumers	149,153	81,735	1,906	1,775	118,263	57,786	1,871	1,745
Government			2,194	2,062			3,253	3,058
Total stocks	172,611	92,248	5,932	5,540	129,824	63,071	6,173	5,780

[1] Revised.

[2] Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.

CONSUMPTION AND USES

Consumption of ilmenite advanced 18 percent in 1943 compared with 1942, but the increase served little more than to compensate for use of lower-grade domestic ores. Ilmenite was used principally in pigments (96 percent) and alloys (3 percent). Rutile consumption spurted 66 percent, and the applications were welding-rod coatings (70 percent) and alloys (over 29 percent).

Consumption of ilmenite and rutile in the United States, 1942–43, by products, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
1942				
Pigments (manufactured titanium dioxide)[1] [2]	244,465	134,964		
Welding-rod coatings[1]	56	28	8,857	8,326
Alloys and carbide	11,802	5,899	1,652	1,526
Ceramics			92	86
Miscellaneous[3]	1,212	521	15	14
Total consumption	257,535	141,412	10,616	9.952
1943				
Pigments (manufactured titanium dioxide)[1]	290,573	137,399		
Welding-rod coatings[1]	194	113	12,358	11,617
Alloys and carbide	10,583	4,546	5,221	4,782
Ceramics			21	20
Miscellaneous[3]	1,472	810	34	32
Total consumption	302,822	142,868	17,634	16,451

[1] "Pigments" include all manufactured titanium dioxide, consumption of which in welding-rod coatings was 4,900 tons in 1942, and 5,700 in 1943.

[2] Partly estimated.

[3] Consists of ilmenite used as a steel flux and rutile used in lamp-electrode coatings and as a steel deoxidizer.

Titanium pigments.—Production of titanium pigments in 1943 was somewhat less than in 1941–42, but sales were greater than in any year except the 1941 peak. The output was approximately three-quarters of capacity, largely because of reductions in the quantity and grade of ilmenite procured. On the other hand, demand greatly exceeded capacity. Government control of distribution was strengthened December 6, 1943 (Order M–353), amended December 24 to include extended pigments containing over 12 percent TiO_2. Titanium dioxide production technology, a comparison of anatase- and rutile-type pigments, and the causes of chalking were described comprehensively.[7] Rutile-type pigments (made from ilmenite but possessing the crystal structure of rutile) have been commercially available only about 3 years and the chalk-resistant type for only 2 years, but already their use is mandatory in a number of Government specifications.[8] Titanium paints such as Ti-Pure and Titanox are noted for covering power, whiteness, and durability and enjoy a greater volume of business than any other white paint. Paper manufacturers have greatly increased their demands for titanium dioxide, a pulp extender that enables reductions as great as 50 percent in paper weight with no loss in opacity.

Welding-rod coatings.—About 481,000 short tons of titanium-coated welding rods were produced in the United States in 1943 compared with 321,000 tons in 1942 and 152,000 tons in 1941. Titanium shields the arc from oxidation during welding and produces a brittle slag that protects the cooling weld deposit.[9] Welding has replaced riveting in much military construction; for example, a Liberty ship uses some 250,000 linear feet of welding in place of 1,000,000 rivets.[10]

Titanium alloys.—Ferrocarbontitanium (15–20 percent Ti, 3–8 percent C) improves the rimming action of steel to be rolled and acts as a deoxidizer in killed steel. Ferrotitanium (18–45 percent Ti, 0.1 percent C max.) prevents intercrystalline embrittlement and weld decay in stainless steel, inhibits brittleness of 5-percent chromium steel, and increases the hardenability of forging steel.[11] Additions of 0.1–0.3 percent Ti to aluminum alloys refine the grain.[12] A titanium predip before phosphoric treatment of surfaces to be zinc plated has been recommended.[13] Titanium-zinc alloys were investigated.[14] Pure titanium metal is used in radio tubes. Titanium carbide is a constituent of hard cutting alloys for machine tools.

Other uses of titanium.—Some steel companies are using 1 part of ilmenite to replace 1 to 4 parts of fluorspar as a flux in making titanium-bearing stainless steel.[15] Titanium tetrachloride, ordinarily made from rutile, is used by the United States Navy to produce smoke screens.

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[7] Benett, A. N. C., and Woodhall, W., Progress and Development in Titanium Oxide and Titanium Pigments: Oil and Colour Trades Jour., vol. 104, November 26, 1943, pp. 798–805; Paint Ind. Mag., vol. 59, No. 3, March 1944, pp. 84, 86, 88, 90, 92, 94.

[8] Dawson, D. H., and Troutman, R. E., Rutile Titanium Dioxide in Specification Paints: Paint Ind. Mag., vol. 58, No. 10, October 1943, pp. 336, 338, 340, 342, 344.

[9] Westendarp, H. O., Jr., Arc Welding Electrodes—How They Are Made: Iron Age, vol. 151, No. 17, April 29, 1943, pp. 39–41.

[10] Science News Letter, vol. 43, No. 21, May 22, 1943, p. 322.

[11] Comstock, George F., Boron Plus Titanium in Heat-Treated Steels: Metals and Alloys, vol. 17, No. 5, May 1943, pp. 978–983.

[12] Bousack, W., Effects of Minor Alloying Elements on Aluminum Casting Alloys. Part II—Aluminum-Silicon Alloys: Bull. Am. Soc. Testing Materials, No. 124, October 1943, pp. 41–51; discussion, No. 126, January 1944, pp. 27–30.

[13] Iron Age, Titanium Predip Process Increases Life of Zinc Coatings: Vol. 153, No. 5, February 3, 1944, p. 55.

[14] Anderson, E. A., Boyle, E. J., and Ramsey, P. W., Rolled Zinc-Titanium Alloys: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 11, No. 2, February 1944, Tech. Pub. 1687, 9 pp.

[15] Metals and Alloys, Ilmenite Ore for Fluorspar: Vol. 18, No. 3, September 1943, p. 680.

PRICES

No price changes affected any form of titanium in 1943. Ilmenite and rutile prices were fixed by the Office of Price Administration February 22, 1943 (Regulation 327), at levels prevailing in March 1942. Ilmenite, 60 percent TiO_2, was nominally quoted at $28–$30 a long ton, f. o. b. Atlantic seaboard, and rutile, 94 percent TiO_2, at 8–10 cents a pound. Steel quoted ferrotitanium, ton lots, at $1.23 per pound of contained Ti for 40- to 45-percent grade and $1.35 for 20- to 25-percent grade; and ferrocarbontitanium, 15–20 percent Ti, at $142.50 a short ton for 6- to 8-percent carbon and $157.50 for 3- to 5-percent carbon. Titanium metal, 96–98 percent, was listed at $5–$5.50 a pound. The base price of manufactured titanium dioxide remained fixed at 14½–16½ cents a pound.

TECHNOLOGY

Types of dynamite stronger and faster than customarily employed are necessary in blasting the dense, tough titanium ore at Tahawus, N. Y.[16] A feature of the mill at that property is a new type of classifier which provides accurate hydraulic sizing of the table feed.[17] The grinding characteristics of rutile have been compared with those of other minerals.[18]

Concentration of a Caldwell County (N. C.) titanium ore containing nearly 70 percent ilmenite, no rutile or magnetite, and a gangue of sericite talc was undertaken on a laboratory scale. The ore, averaging 41 percent TiO_2 and 33 percent FeO, was ground to 80-mesh and concentrated by froth flotation to a product analyzing 54 percent TiO_2 and 39 percent FeO. Methods using either fatty acid-alkali or amine acid reagents appear equally satisfactory. The indicated recovery of ilmenite was 80 percent, which could possibly be improved by re-treatment of middling products. The reagent cost is estimated at not over 12 cents per ton of ore treated.[19]

Titanium ores can be reduced by charging them into an electric furnace with ordinary clay and off-grade coke breeze.[20] If titaniferous magnetite is reduced to sponge iron under conditions not permitting reduction of titanium compounds, the sponge iron can be melted with additions of lime and carbon to yield a highly concentrated titanium slag.[21] Titanium tetrachloride (a smoke-screen chemical) can be produced by treating titanium-bearing clay with carbonyl chloride at 350°–400° C., according to a German patent.[22] Titanium is one of the most hazardous of 14 metal powders tested.[23] Metal Hydrides, Inc., Beverly, Mass., has established a fellowship at Boston University for research on the properties and utilization of titanium hydride.[24]

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[16] Johnson, N. G., How New and Better Industrial Explosives Are Meeting All Wartime Demand: Min. and Met., vol. 25, No. 445, January 1944, pp. 18–19.

[17] Counselman, T. B., Ore Concentration and Milling: Min. and Met., vol. 25, No. 446, February 1944, p. 50.

[18] Coe, Glen Dale, and Coghill, Will H., Contrasts in Grinding Characteristics of Mineral Products: Bureau of Mines Rept. of Investigations 3704, 1943, 11 pp.

[19] McMurray, L. L., Froth Flotation of a North Carolina Ilmenite Ore: Am. Inst. Min. and Met. Eng. Mining Technol., vol. 8, No. 1, January 1944, Tech. Pub. 1653, 6 pp.

[20] Steel, Deoxidizing and Reduction Agent: Vol. 114, No. 4, January 24, 1944, p. 88.

[21] Brassert, Herman A. (to Metals and Minerals Corporation), Titanium-free Steel and a Highly Concentrated Titanium Slag from Ores and Sands Containing Ilmenite: U. S. Patent 2,313,044; Chem. Abs., vol. 37, No. 17, September 10, 1943, p. 5009.

[22] Walter, Noll (to I. G. Farbenindustrie, A. G.), (Titanium Tetrachloride from Clays): German Patent 726,429, September 3, 1942; Chem. Abs., vol. 37, No. 21, November 10, 1943, p. 6418.

[23] Hartmann, Irving, Nagy, John, and Brown, Hylton R., Inflammability and Explosibility of Metal Powders: Bureau of Mines Rept. of Investigations 3722, 1943, 44 pp.

[24] Chemical and Engineering News, vol. 21, No. 5, August 10, 1943, p. 1252.

WORLD PRODUCTION

Data on world production of ilmenite and rutile in recent years are shown in the following table.

World production of titanium concentrates (ilmenite and rutile), 1937–43, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1937	1938	1939	1940	1941	1942	1943
ILMENITE							
Australia:							
New South Wales	681	(1)	742	2,270	4,808	[2] 3,700	(1)
Queensland					254		
Brazil (exports)	120	155	10	12	4,471	(1)	(1)
Canada	3,836	188	3,351	4,114	11,477	9,100	66,880
Egypt	317	90	(1)	(1)	2	[3] 691	(1)
Federated Malay States (exports)	6,290	6,462	11,098	2,596	(1)	(1)	(1)
India, British	182,142	256,268	(1)	[2] 243,850	(1)	(1)	(1)
Norway	84,209	62,724	55,027	(1)	(1)	[2] 60,000	(1)
Portugal	1,133	568	502	899	798		[4] 120
Senegal	3,075	8,436	(1)	5,798	895	(1)	(1)
Spain					71	(1)	(1)
United States	(5)	(5)	13,247	18,750	21,135	70,042	184,657
RUTILE							
Australia:							
New South Wales	[6] 1,141	[6] 460	790	2,044	4,440	[2] 9,100	(1)
Queensland					254		
South Australia		8	2	2	(7)		
Brazil (exports)	768	377	489	499	2,369	4,615	4,557
Cameroun (French)	103	118	[8] 159	[8] 105	(1)	(1)	(1)
Norway	187	124	166	(1)	(1)	(1)	(1)
South-West Africa	16				(1)	(1)	(1)
United States	(5)	(5)	(5)	2,620	2,839	2,402	3,617

[1] Data not available.
[2] Subject to revision.
[3] Includes 26 tons of garnet-ilmenite.
[4] January to September, inclusive.
[5] Bureau of Mines not at liberty to publish figures.
[6] In addition, zircon-rutile-ilmenite concentrates were produced as follows—1937: 73 tons; 1938: 98 tons.
[7] Less than 1 ton.
[8] Exports.

Australia.—The bulk of the Australian titanium output is in the form of mixed zircon, rutile, and ilmenite mined and concentrated on the beaches of New South Wales and shipped to the United States for separation and consumption. The deposits are estimated to contain a million tons of mixed concentrates.[25] One of the companies—Metal Recoveries Pty., Ltd., New Brighton, a subsidiary of International Titanium Co.—produces monthly[26] concentrates containing about 78 tons of rutile.

Brazil.—Deposits of titanium ore in Brazil were described.[27] From its three properties in the municipality of Guarapary, Espirito Santo, the Soc. Monazita e Ilmenita do Brasil, Ltda., principal producer of ilmenite, mined 3,033 metric tons in 1942 compared with 3,939 tons in 1941 and 611 tons in 1940.

Ceylon.—Between 3 and 4 million tons of ilmenite containing 60–62 percent TiO_2 occur in beach sands in northern Ceylon, and an equal quantity is distributed in leaner sands along the eastern and western coasts. Zircon and monazite are associated minerals.[28]

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[25] Canadian Mining Journal, Minerals in Beach Sands: Vol. 64, No. 8, July 1943, p. 430.
[26] Northern Miner, vol. 29, No. 9, May 20, 1943, p. 3.
[27] Miranda, Jose, Areias ilmeniticas no Brasil: Mineracão e Metalurgia, vol. 7, No. 40, September–October 1943, pp. 195–198. Francesconi, Octacilio, Rutilo no Ceara: pp. 207–208.

French West Africa.—Ilmenite is produced near Rufisque and at the mouth of the Casamance River, Senegal. Exploitable deposits of rutile occur in the vicinity of Kouande, Dahomey.

India.—American ships delivering war supplies to India were expected to bring back large quantities of ilmenite in 1943, but there was a scarcity of barges to bring the concentrates from the beaches to the shipping port of Cochin. A pilot plant for making titanium dioxide is in operation in India.[29]

Portugal.—Exports of ilmenite were 1,510 metric tons from the Portuguese American Co. to the United Kingdom in 1942.[30]

Spain.—Titanium deposits are being worked by Industria Titán, S. A., of Barcelona and Sociedad Titania, S. A., of Galicia. Titaniferous magnetite has been found in the Pyrenean foothills near Olot, District of Barcelona, and ilmenite sands along the Sil River District of Galicia. These ores have a TiO_2 content of about 20–25 percent.[31]

Sweden.—The possibility of obtaining titanium as a byproduct of the State shale-oil industry is under investigation.[32]

Union of South Africa.—Sands along parts of the Natal coast, notably at Durban, contain as much as 85 percent ilmenite and 8 percent zircon. Electromagnetic separation has yielded a product analyzing 93 percent ilmenite.[33]

United Kingdom.—Indian ilmenite, 52–54 percent TiO_2, was quoted by Metal Bulletin at 30 s. per long ton, f. a. s., at the end of 1943. Prices of rutile, f. o. b. consumers' works, remained fixed throughout the year at £54 a long ton for Cameroun concentrates, £42–£50 for Indian concentrates, and £45 for Australian concentrates. Ferrotitanium, the demand for which has broadened,[34] cost £100 a long ton for the 2- to 3-percent-carbon grade (20 to 25 percent Ti) and 1 s. 3½ d. per pound for the carbon-free grade. The British Board of Trade planned an inquiry into the titanium pigment cartel allegations by the United States Department of Justice against Imperial Chemical Industries.[35]

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[28] Mining Journal (London), vol. 222, No. 5658, January 29, 1944, p. 63.

[29] Foreign Commerce Weekly, vol. 11, No. 10, June 5, 1943, p. 22.

[30] Mining Journal (London), vol. 221, No. 5649, November 27, 1943, p. 586.

[31] Chemical Age (London), vol. 50, No. 1288, March 4, 1944, p. 234.

[32] Foreign Commerce Weekly, Byproducts of Sweden's Shale-Oil Industry: Vol. 15, No. 2, April 8, 1944, p. 17.

[33] South African Mining and Engineering Journal, Titanium's Industrial Role: Vol. 54, part 1, No. 2635, July 31, 1943, pp. 467–468.

[34] Metal Bulletin (London), No. 2843, November 12, 1943, p. 18.

[35] Metal Bulletin (London), Titanium Cartel Allegations: No. 2808, July 9, 1943, p. 3.

MINOR METALS

By Allan F. Matthews

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Lithium	825
Radium and uranium	825
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Selenium and tellurium	828
Thallium	829

BARIUM AND STRONTIUM

Several thousand pounds of barium metal are produced annually from purchased oxide by Kemet Laboratories Co., Inc. (unit of Union Carbide & Carbon Corporation), Cleveland, Ohio, and King Laboratories, Inc., Syracuse, N. Y. These companies and the Hugh S. Cooper Metallurgical Laboratory, Cleveland, Ohio, produce strontium metal. Barium metal is worth \$5–\$8 a pound and strontium metal \$15–\$20 a pound. These alkaline-earth metals, alloyed with aluminum and magnesium, are used as getters in tubes for radios and other electronic devices.[1] A getter is a material placed inside a tube to absorb residual gases and thus maintain a vacuum.

Barium and strontium minerals are discussed in both the Barite, Witherite, and Barium Chemicals chapter and the Minor Nonmetals chapter of this volume.

BERYLLIUM

General statement.—Beryl production in the United States increased 40 percent in 1943 compared with 1942 but constituted only 7 percent of the new supply. The combination of high shipping priority on imports (some by airplane) and of strict use conservation enabled the beryl supply to meet demand and also approximately to double inventories. Beryllium-copper master-alloy shipments reached a record high in the first half of 1943 but declined 19 percent in the second half—principally because of cut-backs in military demand and the desire of fabricators to reduce their stocks. The surplus was not taken up by marginal military and civilian uses because satisfactory substitutes had been developed and reversion to beryllium-copper would entail increased cost in materials and redesigning, according to the War Production Board. Furthermore, marginal users had no assurance that beryllium would not again become so scarce as to deny them access to supplies.

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[1] Light Metals (London), Gettering and Getters: Vol. 7, No. 73, February 1944, pp. 77–94.

Beryllium in all forms was placed under allocation by the War Production Board June 1, 1942 (Order M–160). The order was amended December 16, 1943, to change allocation from a monthly to a quarterly basis and to exempt from control sales of material containing 2 pounds or less of beryllium.

Domestic mine production.—Domestic mine shipments increased 40 percent in 1943 compared with 1942 to establish another record. Practically the entire output is a byproduct of feldspar, mica, and other pegmatite minerals. The deposit of helvite (sulfosilicate of manganese, iron, and beryllium) at Iron Mountain, Sierra and Socorro Counties, N. Mex., has not been developed because further exploration indicated smaller reserves than expected and because concentration of the ore presented difficulties. A reportedly large find of beryllium in Jackson County, Oreg., proved to be nonexistent.[2] The Bureau of Mines and Geological Survey continued to examine deposits in New England, the Appalachians, Black Hills, and Rocky Mountains.

Beryllium ore shipped from mines in the United States, 1937–43, by States, in short tons

	1937	1938	1939	1940	1941	1942	1943
Colorado	(1)	--------	(1)	(1)	--------	3	68
Maine	(1)	25	(1)	(1)	(1)	45	2
New Hampshire	--------	--------	--------	--------	(1)	16	42
South Dakota	(1)	--------	84	74	151	205	238
Other [2]	75	--------	11	47	7	--------	6
Total:							
Short tons	75	25	95	121	158	269	356
Value	$1,640	$770	$2,720	$3,721	$7,300	$24,188	$44,407
Average per ton	$21.87	$30.80	$28.63	$30.75	$46.20	$89.92	$124.74

[1] Included in "Other." Bureau of Mines not at liberty to show separately.
[2] 1937: Colorado, Maine, South Dakota; 1939: Colorado, Maine; 1940: Colorado, Maine; 1941: Maine, New Hampshire, Wyoming; 1943: Massachusetts, New Mexico, North Carolina, Virginia.

Domestic refinery production.—The Bureau of Mines is not at liberty to release production data on beryllium products, but an idea of the size of the recently expanded industry can be obtained from a statement by the National Research Council[3] that the annual rate of output in early 1943 was 3,000,000 pounds of beryllium-copper master alloy (4 percent Be) and 10,000 pounds of beryllium oxide for phosphorescent lamps; consumption of beryl was stated to be about 7 tons daily. Beryllium-copper master alloy is made by the Beryllium Corporation of Pennsylvania, Reading, Pa., and by Brush Beryllium Co., Cleveland, Ohio. The latter company also produces metal and compounds. Clifton Products, Inc., Painesville, Ohio, a producer of oxide, began making metal in late 1943 and is expected to begin beryllium-copper output in 1944.

Foreign trade.—Beryl imports more than doubled in 1943 compared with 1942, and every inhabited continent contributed to the supply. Exports in 1943 comprised 4,903 pounds of beryllium ore, 54,990 pounds ($49,867) of alloys and metal, and 3,915 pounds ($14,730) of compounds.

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[2] Engineering and Mining Journal, vol. 144, No. 6, June 1943, p. 107.
[3] National Research Council, War Metallurgy Committee, Beryllium: Inf. Release 3, April 1943, 9 pp.

Beryllium ore imported for consumption in the United States, 1939–43, by countries, in short tons

Country	1939	1940	1941	1942	1943
Argentina	384	422	861	703	1,162
Australia					457
Brazil	75	377	1,805	912	2,551
India and Dependencies				397	509
Madagascar					74
Portugal					1
Union of South Africa		6		38	86
Total:					
Short tons	459	[1] 805	2,666	2,050	4,840
Value	$14,574	$23,865	$143,992	$137,597	$377,726
Average per ton	$31.75	$29.65	$54.01	$67.12	$78.04

[1] Five tons in addition from Mozambique were reported to the Bureau of Mines.

Stocks.—Inventories of beryl held by the principal miners, dealers and consumers in 1943 declined from 1,400 short tons on January 1 to 1,100 tons on December 31. However, Government-owned Metals Reserve Co. increased its stocks from 725 tons to 2,513 during the year.

Prices.—Domestic beryl, 10–12 percent BeO, was priced at $83–$100 a short ton ($8.33 per unit) in the first 4 months of 1943 and $120–$144 a ton ($12 per unit) during the remainder of the year. Beryllium-copper master-alloy was quoted at $15–$17 a pound.

Uses.—The principal application of beryllium is in beryllium-copper alloys (0.1–3.5 percent Be; 0–2.6 percent Co, Cr, or Ag; remainder Cu), described by the National Academy of Sciences [4] as follows:

> Beryllium-copper is heat treatable to produce the strongest copper-base alloy. Extensive studies have been carried out in various laboratories in endeavors to broaden the use of beryllium-copper alloys and to take advantage of their valuable properties of high fatigue strength; elastic limit and hardness; relatively high tensile strength and electrical conductivity; excellent corrosion resistance; good wear resistance; good resistance to galling against steel and good resistance to room temperature creep (elastic drift); and various fabrication advantages associated with heat treatment or precipitation hardening.
>
> There can be no doubt as to the relative superiority of this alloy for many important applications in both the peacetime and the wartime economy. At the present time beryllium-copper is being used in parts of aircraft, ships, tanks, guns, shells, instruments, engines, motors, radio, telephones, telegraph, tools, and electrical control equipment for machinery and fire protection. In many cases, where small parts are involved, design factors explain the use of this alloy. Thus, in many aircraft instruments, beryllium-copper is used because its properties make possible the use of a smaller part than would be necessary if other materials were used.

Beryllium oxide is used in fluorescent lamps as a white phosphor, in spark plugs and other refractories, and in experimental glasses.[5] Beryllium metal is fabricated into windows for X-ray tubes,[6] and small quantities (0.0001–0.001 percent Be) are added to aluminum-magnesium castings and extrusions. Platinum metals can be conserved by fractional beryllium additions.[7]

Technologic developments.—The Bureau of Mines conducted numerous experiments on the concentration and analysis of beryllium ores in 1943, and publication of results is expected soon. Spot tests[8] and spectrographic methods[9] of detecting beryllium were described. Recent patents give clues to present refining processes.[10] Heat treating of beryllium-copper was studied further.[11] Investigations by the Public Health Service indicate that beryllium is not toxic,[12] but a refiner questions such a conclusion.

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[4] See footnote 3.

[5] Sun, Kuan-Han, Beryllium in Glass: Glass Ind., vol. 24, No. 4, April 1943, pp. 155–156, 172; No. 5, May 1943, pp. 217–220, 222.

[6] Atlee, Zed J., Beryllium Windows: General Electric Rev., vol. 46, No. 4, April 1943, pp. 233–236.

[7] Frohlich, K. W. (Substitution of Iridium and Other Platinum Metals by Beryllium): Degussa Metall-Ber., 1941, pp. 114–135; Chem. Abs., vol. 37, No. 17, September 10, 1943, p. 4999.

Foreign production.—Argentine beryl production in 1942 was from the Provinces of Córdoba (848 metric tons), San Luis (74 tons), and Catamarca (3 tons); future output is expected to decline. The refining plant at Juan Ortiz is not in operation. The Australian production is primarily from the Wodgina tantalite district of Western Australia and the Brazilian output from the States of Paraiba and Rio Grande do Norte. Madagascar ships beryl from the Fianarantsoa mine, about 100 miles inland by rail from the port of Manakara. South-West Africa exported 77 metric tons of beryl to the United Kingdom in 1942. The chief source of beryl in the Soviet Union is the Sherlova Gora mine (latitude 52°33′ N., longitude 116° 15′ E.) in Transbaikal, although there are at least 25 other promising deposits in the country.

World production of beryllium ore, 1937–43, by countries, in metric tons[1]

Country	1937	1938	1939	1940	1941	1942	1943
Argentina	260	753	299	520	1,986	925	[2] 1,054
Australia	-------	-------	6	2	[3] 2	(4)	[2] 415
Brazil (exports)	-------	203	276	1,472	1,703	1,634	2,027
India and Dependencies	24	15	9	(4)	(4)	[2] 360	[2] 462
Madagascar (estimated exports)	2	2	(4)	(4)	(4)	(4)	[2] 67
Portugal	21	[5] 265	(4)	(4)	35	(4)	[2] 1
Spain	-------	-------	-------	4	(4)	(4)	(4)
South-West Africa	(4)	(4)	(4)	(4)	20	[6] 18	[6] 36
Union of South Africa (estimate)[2]	(4)	(4)	(4)	5	(4)	34	78
United States (mine shipments)	68	23	86	110	143	244	323
Total reported	375	1,261	676	2,113	3,889	3,215	4,463

[1] In addition to countries listed beryllium ore may also be produced in France, Italy, Kenya, Norway, Portuguese East Africa, Rumania, and U. S. S. R. Canada has produced beryl but has sold none.
[2] Estimate based upon United States imports.
[3] South Australia only.
[4] Data not available.
[5] Exports; subject to revision.
[6] January to September, inclusive.

BORON

Production.—Ferroboron (3–18 percent B) production in the United States was 190 short tons containing 15 tons of boron in 1942, and producers' shipments were 113 tons. Corresponding figures for 1943 are not yet available. The producers of ferroboron are Electro Metallurgical Co., Molybdenum Corporation of America, and Ohio Ferro-Alloys Corporation. In addition, complex alloys (0.1–1.9 percent B), such as Bortam, Carbortam, Grainal, Silcaz, and Silvaz are produced by the Electro Metallurgical Co., Titanium Alloy Manufacturing Co., and Vanadium Corporation of America. Amorphous boron, manganese-boron, and nickel-boron are now marketed. Mineral sources and salts of boron are discussed in the Magnesium Compounds and Miscellaneous Salines chapter of this volume.

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[8] Kulcsar, Frank, How Prospectors Can Detect Beryllium in Ores: Eng. and Min. Jour., vol. 144, No. 12, December 1943, p. 103.

[9] Peer, Kenneth C., Spectrographic Determination of Beryllium: Light Metal Age, vol. 1, No. 4, November 1943, pp. 14–15, 22.

[10] Kawecki, Henry C. (to Reconstruction Finance Corporation), Process for Extracting Beryllium Compounds from Silicate Minerals: U. S. Patent 2,312,297, February 23, 1943.

Sawyer, Charles B. (to The Brush Beryllium Co.), Electrolytic Beryllium and Process: U. S. Patent 2,311,257, February 16, 1943.

[11] Martin, Wayne, Heat Treating Beryllium Copper: Iron Age, vol. 153, No. 8, February 24, 1944, pp. 66–71.

[12] Hyslop, Frances, and others, The Toxicology of Beryllium: Public Health Service, Nat. Inst. Health Bull. 181, 1943, 56 pp.

Uses in steel.—Additions of 0.001 to 0.003 percent (one-third ounce per ton) of boron to steel promote an increase in hardenability (depth of hardness) comparable to that obtained by much larger quantities of the common alloying elements.[13] For example, treatment of a medium-carbon steel with boron alloy increases hardenability about as much as raising the manganese content 0.7 percent, raising the silicon content 1.6 percent, or adding 0.20–0.25 percent molybdenum; furthermore, the boron steel is tougher, at least as ductile, and practically as strong as a similar untreated steel with 0.25 percent molybdenum, and the heats are more uniform.[14] Machinability of fine-grained steels is said to be improved by boron. Although particularly effective in pearlitic manganese steel, boron makes a carbon steel equivalent to a low-alloy steel in hardenability and mechanical properties and makes a low-alloy steel equivalent to a high-alloy steel.[15] Boron is economical to use [16] and conserves strategic ferroalloy metals. Additions must be made to a completely deoxidized steel bath, or the boron must be protected by strong deoxidizers until dissolved. Methods of measuring small quantities of boron have been developed.[17]

Other metallurgical uses.—In cast iron 0.001 percent of boron considerably shortens the annealing cycle,[18] and 0.02–0.12 percent reportedly increases hardness and refines the grain. Boron controls the depth of chill in iron rolls for the steel industry. Chromium-boron is a hard-facing alloy overlayed on shovel tips, clutch fingers, and other abraded surfaces. Boron alloys make efficient resistor elements.[19]

Prices.—Ferroboron, 17.5 percent B, carlots, was quoted at $1.25 a pound in 1943, according to Iron Age.

CALCIUM

Calcium metal is produced on a tonnage scale by the Electro Metallurgical Co. at its Sault Ste. Marie (Mich.) plant. Shipments were placed under allocation control by the War Production Board informally at the beginning of 1943 and officially April 1 (Order M–303), but the balancing of supply and demand permitted suspension of the order August 18, 1943. Calcium metal, 97–98 percent, ton lots, continued to be quoted at $1.25 a pound throughout 1943.

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[13] Horton, F. W., Production Problems Face Ferro-Alloy Metallurgists: Eng. and Min. Jour., vol. 145, No. 2, February 1944, pp. 103–104.

Macconochie, Arthur F., Boron Assumes a Position of Importance as an Alloying Element in Steel: Steel, vol. 113, No. 16, October 18, 1943, pp. 106, 108, 129.

Tisdale, Norman F., Boron Found to Be a Very Beneficial Alloying Element: Blast Furnace and Steel Plant, vol. 31, No. 1, January 1943, pp. 93–94.

[14] Comstock, George F., Boron Plus Titanium in Heat-Treated Steels: Metals and Alloys, vol. 17, No. 5, May 1943, pp. 978–983.

[15] Schenck, R. B., Special Addition Agents: Steel, vol. 113, No. 14, October 4, 1943, pp. 96–98, 100, 102, 104, 130.

[16] Comstock, George F., Comparative Effects of Boron and Manganese: Iron Age, vol. 152, No. 11, September 9, 1943, pp. 48, 52.

[17] Rudolph, G. A., and Flickinger, L. C., Colorimetric Determination of Boron in Steel Using Quinalizarin Reaction: Steel, vol. 112, No. 14, April 5, 1943, pp. 114, 131, 149.

Iron Age, Boron—How to Find It, What It Does: Vol. 151, No. 8, February 25, 1943, pp. 56–57.

[18] Schwartz, Harry A., Boron as an Accelerator of Malleable Annealing: Foundry, vol. 72, No. 4, April 1944, pp. 129, 182.

[19] Walther, Henry (to Bell Telephone Laboratories, Inc.), Preparation of Boron Compositions: U. S. Patent 2,313,410, March 9, 1943.

According to Canadian Metals & Metallurgical Industries, calcium-silicon, ton lots, was 16½ cents a pound, f. o. b. Welland, Ontario. Calcium metal and alloys are used primarily in deoxidizing and scavenging steel.[20] Calcium lead (0.1–0.4 percent Ca) [21] is made into cable sheaths, storage-battery grids, and bearings.[22] Calcium improves the grain structure, workability, and corrosion resistance of magnesium alloys.[23]

Calcium metal and calcium-silicon imported for consumption in the United States, 1939–43

Commodity	1939		1940		1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Calcium metal	41,718	$17,758	11,900	$6,518	--------	--------	--------	--------	--------	--------
Calcium-silicon	3,972,571	225,312	2,131,758	154,424	111,994	$8,337	60,300	$10,144	--------	--------

CERIUM AND OTHER RARE-EARTH METALS

Cerium master alloy (misch metal) production in the United States was 212,379 pounds in 1943, according to the War Production Board. The producers were Cerium Metals Corporation, Niagara Falls, N. Y.; Kent Metal & Chemical Works, Edgewater, N. J.; and New Process Metals Corporation, Newark, N. J. A typical composition of the master alloy is 52 percent cerium, 22 percent lanthanum, 15 percent neodymium, 7 percent other rare-earth metals (praseodymium, samarium, yttrium, and terbium), and 4 percent iron.[24] The master alloy is diluted to 20–35 percent iron content; and a few percent of boron, silicon, calcium, or other metal is added for special effects, in making ferrocerium for sparking "flints" of cigarette lighters, miners' lamps, and acetylene-welding torches. Small quantities of cerium metal are used in radio tubes and nonferrous alloys. Magnesium alloys usable at higher temperatures than now possible can be developed by additions of cerium.[25]

Imports of cerium alloys from Canada, only foreign source since the outbreak of war, totaled 5,720 pounds ($27,589) in 1943 compared with 11,573 pounds ($65,549) in 1942. Imports of cerium compounds were 119 pounds ($304) in 1943. Exports of cerium alloys and metal were 54,797 pounds ($148,891) in 1943 compared with 26,016 pounds ($84,739) in 1942. The Canadian producer is Shawinigan Chemicals, Ltd., Shawinigan Falls, Quebec. Misch metal (52 percent Ce) is quoted by Metal Bulletin (London) at 35 s. a pound and cerium metal at £7 5 s. a pound. Ferrocerium production was begun in Australia from local ores.[26]

The principal ore of cerium is monazite,[27] described in the Minor Nonmetals chapter of this volume.

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[20] Sanderson, L., Calcium and Some of Its Applications: Metallurgia (London), vol. 27, No. 162, April 1943, pp. 245–246.

[21] Mantell, C. L., and Hardy, Charles, Engineering Alloys Containing Calcium: Metals and Alloys, vol. 19, No. 2, February 1944, pp. 364–366.

[22] Engineering and Mining Journal, Calcium-Bearing Alloys: vol. 144, No. 10, October 1943, p. 83.

[23] See footnote 21.

[24] David, Leo, Cerium and Some of Its Applications: Metallurgia (London), vol. 28, No. 168, October 1943, pp. 264–265.

[25] Gillett, H. W., Metallic Materials: Steel, vol. 114, No. 7, February 14, 1944, p. 112.

[26] Mining Journal (London,) Chemical Treatment of Monazite: Vol. 221, No. 5645, October 30, 1943, pp. 526–527.

[27] Houk, Lawrence G., Monazite Sand: Bureau of Mines Inf. Circ. 7233, 1943, 19 pp.
Sanderson, L., Monazite: Canadian Min. Jour., vol. 64, No. 4, April 1943, pp. 208–209.

CESIUM AND RUBIDIUM

Cesium metal and salts and rubidium salts are produced by the Maywood Chemical Works, Maywood, N. J., from pollucite it extracts at the Tin Mountain mine, 7 miles west of Custer, Custer County, S. Dak. Cesium salts are produced by the Foote Mineral Co., Philadelphia, Pa. Occurrences of cesium and rubidium in New England were recently described.[28] Efforts were being made in May 1944 to import several tons of pollucite from the Union of South Africa. Cesium metal (100 percent Cs, 100-gram lots) was quoted at $4 a gram and the salts of cesium and rubidium at 15–50 cents a gram in September 1943, according to Maywood Chemical Works. Small quantities of cesium and rubidium are used in photoelectric cells and radio tubes. Important quantities of these metals have been discovered in the Boliden mines at Varutrask, Sweden.

COLUMBIUM AND TANTALUM

Tantalum, placed under allocation control by the War Production Board, May 22, 1942 (Order M–156), has been one of the most critical metals of World War II. Two-thirds of the tantalite imports and some of the columbite arrived via airplane in 1943. Ferrocolumbium allocation began March 25, 1943 (Order M–296). In contrast to the gradual easing of supply of most other ferroalloys, the use of ferrocolumbium was restricted in December to those applications in aircraft construction in which ferrotitanium or other materials have proved ineffective.

Domestic production.—Columbium-ore shipments in 1943 included 2,970 pounds from the McKinney mines of the Carolina Mineral Co. and Whitehall Co., Inc., Spruce Pine area, Mitchell County, N. C., and 615 pounds from Robert A. Shipley, Canon City, Fremont County, Colo. Tantalum-ore shipments by Arthur Montgomery, Harding mine, Dixon, Taos County, N. Mex., comprised 6,137 pounds of microlite (71 percent Ta_2O_5, 6 percent Cb_2O_5), 1,075 pounds of microlite (65 percent Ta_2O_5, 9 percent Cb_2O_5), and 464 pounds of tantalite (43 percent Ta_2O_5, 36 percent Cb_2O_5).

Columbium and tantalum ores shipped from mines in the United States, 1938–43, by States

Year	Pounds					Total	
	Colorado	New Mexico	North Carolina	South Dakota	Wyoming	Pounds	Value
COLUMBIUM ORE							
1938		2,000				2,000	$1,000
1939		280				280	140
1940							
1941							
1942							
1943	1,225	190	4,219	137		5,771	1,465
TANTALUM ORE							
1938				33,922	267	34,189	34,127
1939				35	25	60	60
1940							
1941					250	250	219
1942				200		200	175
1943	1,000	7,676		735		9,411	27,621

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[28] Hess, Frank L., Whitney, Roscoe J., Trefethen, Joseph, and Slavin, Morris, The Rare Alkalis in New England: Bureau of Mines Inf. Circ. 7232, 1943, 51 pp.

Ferrocolumbium is produced by the Electro Metallurgical Co., Niagara Falls, N. Y., and tantalum metal by the Fansteel Metallurgical Corporation, North Chicago, Ill. Part of the output of the latter company is in the Government-owned Tantalum Defense Corporation plant, for which the Defense Plant Corporation, subsidiary of the Reconstruction Finance Corporation, provided $5,350,000.

Foreign trade.—Imports are shown in the following table. Exports in 1943 comprised 27 pounds ($37) of ferrocolumbium and 184 pounds ($15,447) of tantalum metal and alloys. There were no exports of tantalum ore or compounds.

Columbium and tantalum ores imported for consumption in the United States, 1941–43, by countries, in pounds

Country	Columbium ore			Tantalum ore		
	1941	1942 •	1943	1941	1942	1943
Argentina	2,914		2,685			2,420
Australia				29,574	[1] 1,470	10,708
Belgian Congo		36,422		146,904	309,843	157,073
Brazil	2,229	1,133		161,996	237,210	416,874
India and Dependencies			21,600			1,805
Mozambique						3,567
Nigeria	1,435,312	1,724,800	2,350,329			5,757
Southern Rhodesia				64,773	18,971	40,481
Uganda			3,111			3,063
Union of South Africa			4,325	217		1,332
Total: Pounds	1,440,455	1,762,355	2,382,050	403,464	567,494	643,080
Value	$504,537	$608,917	$844,544	$188,936	$467,418	$724,066

[1] Classified by U. S. Department of Commerce as from New Zealand, which has no recorded production.

Stocks.—The Government stock pile held by the Metals Reserve Co. (or its agent, the Colonial Mica Co.) included 11,371 pounds of columbite, 1,050 short tons of columbite-bearing slag, and 376,441 pounds of tantalite at the end of 1943. This compares with a Government inventory of no columbite and 427,756 pounds of tantalite at the end of 1942.

Prices.—Government-owned Metals Reserve Co. began May 1, 1943, purchasing columbium ore (minimum 50 percent Cb_2O_5 and not more than 7.5 percent TiO_2 or 5 percent SnO_2) at 25 cents a pound (gross weight, no payment for Ta_2O_5 content); and tantalum ore (minimum 40 percent Ta_2O_5 and not more than 3 percent TiO_2 or 3 percent SnO_2) at $1.75 per pound of contained Ta_2O_5 for 40-percent material, $2.25 for 50-percent, $2.75 for 60-percent, and $3.25 for 70-percent material. E&MJ Metal and Mineral Markets continued to quote ferrocolumbium, 50–55 percent Cb, at $2.25–$2.30 per pound of contained Cb; columbium metal at $500–$560 per kilogram ($227–$254 per pound); and tantalum metal at $143–$160.60 per kilogram ($65–$73 per pound).

Uses.—Corrosion-resistant steels containing 0.5–0.8 percent columbium are used in aircraft exhaust systems,[29] supercharger systems, and engine parts exposed to temperatures exceeding 800° F. and subject to severe corrosion or conditions likely to result in fatigue failures. Half of the tantalum consumed in 1943 was for radio and other electronic tubes. One manufacturer (Westinghouse Lamp Division) stated in the fall of 1943 that its tube production was 11 times as great as 2 years ago. Potassium-tantalum fluoride is a catalyst for butadiene synthetic rubber, tantalum carbide a component of cutting tools, and tantalum oxide a constituent of silicaless glass for aerial camera lenses. Among the most corrosion-resistant metals, tantalum is used in chemical equipment and in skull plates and other surgical applications.[30]

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[29] Campbell, H. A., Stainless Steel Aircraft Exhausts: Iron Age, vol. 151, No. 25, June 24, 1943, pp. 56–58.

Foreign production.—The Jantar Nigeria Co., Ltd., produced about 500 metric tons of columbite in the year ended September 30, 1943.[31] Prospecting and developing columbite and tantalite deposits in Nigeria has been placed under Government license control.[32] Argentina produced 5 metric tons of columbium-tantalum ore in 1942. Columbite was discovered in British Guiana. Brazil exported 180.8 metric tons of tantalite in 1943—all to the United States. The Brazilian deposits were described comprehensively.[33] Belgian Congo output of tantalite, largely by the Geomines group, is reported tentatively at 160 metric tons in 1943. Tantalum has been discovered at Sproul Lake, 35 miles northeast of Yellowknife, Northwest Territories, Canada.[34]

GERMANIUM

Small quantities of germanium metal, oxide, and chloride were produced by the Eagle-Picher Lead Co., Joplin, Mo., in 1943. Cadmium flue dust generally contains germanium, but no demand has yet developed that is sufficient to warrant systematic production. Germanium is a catalyst in the hydrogenation of coal.[35] The metal is quoted at 19s. 6d. per gram and the oxide at 15s. for 99.5-percent and 22s. 6d. for 100-percent, according to the Metal Bulletin.

INDIUM

Domestic production.—Indium-metal production in the United States in 1943 increased more than a third over 1942. The Bureau of Mines is not at liberty to publish production figures, but the Wall Street Journal stated that the indium output was about 65,000 troy ounces in 1942.[36] Sales of indium metal and salts tripled in 1942 compared with 1941 and nearly tripled again in 1943, according to a brochure of the Indium Corporation of America, Utica, N. Y., principal distributor of indium and a subsidiary of Anaconda Copper Mining Co. and Oneida, Ltd. (silverware manufacturer). Indium output—a byproduct of zinc and lead operations—is made predominantly by the Anaconda Copper Mining Co. but also by the American Metal Co., Ltd., American Smelting & Refining Co., and National Zinc Co.,

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[30] Business Week, Doctor's War Aid: No. 738, October 23, 1943, pp. 28–29.
Mining and Metallurgy, New Metals in Surgery: Vol. 25, No. 446, February 1944, p. 125.

[31] Mining Journal (London), vol. 221, No. 5653, December 25, 1943, p. 647.

[32] Foreign Commerce Weekly, Nigeria: Vol. 14, No. 10, March 4, 1944, p. 18.

[33] de Almeida, Sandoval C., Johnston, W. D., Jr., Scorza, Evaristo P., and Leonardos, Othon H., Pegmatitos cum berilo, tantalita e cassiterita da Paraiba e Rio Grande do Norte: Mineraçao e Metalurgia, vol. 7, No. 9, July–August 1943, pp. 115–126, 25 photographs, 10 maps and cross sections.
Office of the Coordinator of Inter-American Affairs, Brazil's Role in World Output of Tantalite—One of Today's Notable "Imports by Air": For. Commerce Weekly, vol. 14, No. 3, January 15, 1944, pp. 6–7, 30.
Chemical and Metallurgical Engineering, New Source of Tantalum: Vol. 50, No. 11, November 1943, pp. 206–207.

[34] Northern Miner, Tin and Tantalum at Sproul Lake: Vol. 29, No. 32, October 28, 1943, pp. 18–19.

[35] Chemical Age (London), Germanium in Coal Ash: Vol. 49, No. 1271, November 6, 1943, p. 473

[36] Cleaves, Freeman, A Dash of Rare Indium Toughens Other Metals for Wartime Jobs: Wall Street Jour., vol. 112, No. 22, July 27, 1943, p. 1.

Inc. A few grams were recovered upon a laboratory basis by Eagle-Picher Mining & Smelting Co. and the Sherwin-Williams Co. in 1943.

Prices.—The price of indium metal, 99 percent, was $10 per troy ounce during 1943 and until March 14, 1944, when the price of metal, now listed as 99.9 percent, was reduced to $7.50–$8.50, according to E&MJ Metal and Mineral Markets.

Uses.—Indium coatings increase the resistance of aircraft-engine bearings to corrosion and wear under severe operating conditions, and this application absorbed almost all of the metal consumed in 1943. Small quantities of indium were used for decorative plating and solders. Indium-zinc coatings have proved satisfactory for airplane hollow-steel propeller blades. Indium-zinc [37] and indium-gold [38] alloys have been described, and an annotated bibliography of indium has been published.[39]

Foreign production.—Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, British Columbia, produced 471 troy ounces of indium in 1942 and none in 1943. Sphalerite specimens from British Columbia and Germany and stannite samples from British Columbia and Bolivia were found spectrographically to contain at least 0.1 percent In.[40]

LITHIUM

Lithium metal is produced by Lithaloys Corporation, New York, N. Y., and Maywood Chemical Works, Maywood, N. J. It is added to copper-base alloy melts as a scavenger and is a minor constituent of certain nonferrous alloys. Lithium metal, 98–99 percent, 100-pound lots, was quoted at $15 a pound throughout 1942, according to E&MJ Metal and Mineral Markets.

Ores and compounds of lithium are discussed in the Minor Nonmetals chapter of this volume.

RADIUM AND URANIUM

Radium was in strong demand during 1943, notwithstanding certain trade-journal comments to the contrary. The uranium industry was greatly stimulated by a Government program having materials priority over all other military procurement, but most of the facts were buried in War Department secrecy.

Domestic production.—Radium and uranium are produced as an accessory of vanadium from carnotite ores mined in Arizona, Colorado, and Utah, but figures are not available for publication at this time.

Foreign trade.—Radium imports reached a record high in 1943. All the radium, mesothorium, and uranium imported in 1942–43 came from Canada, except entries of 100 milligrams of radium from Belgium (originally) and 525,559 pounds of uranium ore from Belgian Congo in 1942. Exports in 1943 comprised 82 milligrams ($1,610) of radium, 2,571 milligrams of radium compounds ($65,937), 865 milligrams of mesothorium ($20,758), and 145,613 grams ($1,972) of uranium compounds.

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[37] Rhines, F. N., Constitution of the System Indium-Zinc: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 11, No. 2, February 1944, Tech. Pub. 1682, 10 pp.

[38] Indium Corporation of America, Gold-Indium Alloys: Indium News, vol. 1, No. 2, 1943, 4 pp.; Iron Age, vol. 152, No. 10, September 2, 1943, p. 49.

[39] Ludwick, Maria Thompson, A Bibliography of Indium, 1941–42 Supplement: Indium Corporation of America, New York, 1943, 36 pp.

[40] Warren, Harry V., and Thompson, Robert M., Indium in British Columbia: The Miner (Vancouver), vol. 16, No. 12, December 1943, pp. 39–40.

Radium salts, radioactive substitutes, and uranium ore and compounds imported for consumption in the United States, 1939–43

Year	Radium salts			Radioactive substitutes [1] (value)	Uranium ore		Uranium oxide and salts	
	Grams	Value						
		Total	Average per gram		Pounds	Value	Pounds	Value
1939	78.631	$1,953,820	$24,800	$966	5	$10	1,439,324	$1,197,786
1940	30.311	748,097	24,700	5,650	2,400,198	2,110,927	240,199	388,355
1941	4.412	110,202	25,000	13	----------	----------	387,505	501,370
1942	23.043	377,326	16,400	50	541,307	806,919	377,398	851,098
1943	90.755	1,366,538	15,100	35,589	----------	----------	211,348	413,410

[1] Principally mesothorium.

Prices.—Radium was nominally quoted at $25 a milligram during 1943, but actual sales probably averaged lower. Orange or yellow sodium uranate remained at $1.65 a pound, and black uranium oxide was not quotable, according to Glass Industry.

Uses of radium.—Radium is considered one of the most effective weapons in combatting cancer, although it now shares popularity with newer therapeutic agents, for example, high-voltage X-rays and artificially radioactivated elements. About 157 grams of radium were in medical use in the United States in 1939, according to the National Cancer Institute, Public Health Service. Dial painting of aircraft and ship-instrument panels, military ground-direction markers, compasses, watches, gun sights, and other instruments consumed approximately 75 grams of radium in 1943 compared with 40 grams in 1942, according to the War Production Board. This use is expected to decline because the number of aircraft dials radium-coated has been reduced to the most essential six per plane to avoid night blindness of pilots; other dials will be fluorescent and activated by ultraviolet (invisible) lamps illuminated only at certain intervals. Radium pigments made by mixing 1 part of radium with about 4,000 parts of phosphorescent zinc sulfide retain their luminosity some 6 to 8 years, after which the sulfide crystals are destroyed. Poisoning is still a problem in that phase of the industry.[41] In 1943 about 25 grams of radium were put into medical and industrial radiographic use, largely the latter. In the inspection of heavy castings and welds, the use of radium has increased almost equally with X-rays as a source of radiation;[42] greater utilization of both techniques will undoubtedly be made after the war than before.[43] Radium diffusion for measuring large quantities of water was tried experimentally.[44] The number of radioactive specimens tested annually by the National Bureau of Standards gives some index as to demand. Such specimens contained 35,193 milligrams of radium and 2,276 milligrams of mesothorium in 1943 compared with 16,408 and 2,139 milligrams, respectively, in 1942. A method of analyzing small quantities was described.[45] Polonium, a byproduct of radium, is a radioactive metal plated on spark plugs to ionize the air gap.[46]

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[41] Science News Letter, Dial Paint Poisonous: Vol. 44, No. 21, November 20, 1943, p. 323.

[42] McCutcheon, Don M., Radiography: Metals and Alloys, vol. 17, No. 1, January 1943, p. 121.

[43] Eddy, W. P., Jr., Effects of Wartime Developments on Future Steels: Steel, vol. 114, No. 7, February 14, 1944, p. 136.

[44] Science News Letter, Radium Method Difficult: Vol. 43, No. 18, May 1, 1943, p. 285.

[45] Curtiss, Leon F., and Davis, Francis J., A Counting Method for the Determination of Small Amounts of Radium and Uranium: Nat. Bureau of Standards Jour. Research, vol. 31, No. 3, September 1943, Research Paper 1557, pp. 181–195.

Radioactivated elements.—Atom-smashing cyclotrons are bestowing the property of radioactivity upon a dozen common elements for use in medicine and industry. The use of radiophosphorus as a tracer in experimental steel melts, for example, demonstrated that phosphorus impurities of cast iron and steel concentrate around the blowholes on the surface. The presence and distribution of carbon, sulfur, manganese, and silicon in steel can likewise be determined.[47] In the medical field, artificially radioactivated elements are superior to radium and X-rays in their ability to migrate to cancerous tissue without harming healthy tissue. Cancer of the bone, for example, is treated with radiostrontium and radiocalcium, both of which (after being taken into the body) go immediately to the bones, particularly to new-forming tissue and cancerous growths in bones. Small tracer doses of these elements also give information about the action of vitamin D in rickets. Radiophosphorus is used in the treatment of blood diseases like leukemia, and radio-iodine in the treatment of tumors and enlargement of the thyroid gland. Radiosulfur has been used with vitamin B_1 to indicate how much of the vitamin the body retains and how long. Radiorubidium and radiopotassium are useful tools for studying the life processes of living plants.

Uses of uranium.—Most of the 1943 uranium supply was used by physics laboratories for research on uranium isotopes as a source of energy. The principal pre-war outlet for uranium was as a colorant in ceramics, but this use was largely prohibited by the War Production Board, January 26, 1943 (Order M-285). Pottery manufacturers have subsituted a combination of iron and antimony for uranium.[48] Several thousand pounds of uranium compounds were allowed to be consumed in 1943 in amber signal lenses and in glass of specific coefficient of expansion for glass-to-metal contacts in radio tubes.

Foreign production.—The Canadian Government placed sales of radium and uranium under permit control February 15, 1943,[49] reserved to the Crown all future discoveries of radioactive substances in the Northwest Territories and Yukon,[50] and took over the assets of the world's principal producer, Eldorado Mining & Refining, Ltd. (formerly Eldorado Gold Mines, Ltd.), January 28, 1944. The 3,905,046 shares were purchased at $1.35 a share; stock quotations had ranged between 21 cents and $1.64 a share in 1940–44 and 86 cents and $8.10 a share in 1933–34.[51] Exploration [52] and refining [53] of Canadian ores were described. Bear Exploration & Radium, Ltd., sold its Contact Lake silver-radium mine (9 miles southeast of the Eldorado mine) to International Uranium Mining Co., Ltd.[54]

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[46] Dillon, John H. (to The Firestone Tire & Rubber Co.), Method of Plating Polonium: U. S. Patent 2,339,545, January 18. 1944.

[47] Iron Age, vol. 148, No. 26, December 25, 1941, p. 51.

[48] Business Week, Potters Clean Up: No. 755, February 19, 1944, p. 54.

[49] Canadian Chemistry and Process Industries, Radium and Uranium: Vol. 27, No. 3, March 1943, p. 40.

[50] Precambrian, Reserve Radium Minerals: Vol. 16, No. 10, October 1943, p. 15.

[51] Northern Miner, Government Takes Over Eldorado: Vol. 29, No. 46, February 3, 1944, p. 17.

[52] Ridland, G. Carman, Use of the Geiger-Muller Counter in the Search for Pitchblende-Bearing Veins at Great Bear Lake, Canada: Am. Inst. Min. and Met. Eng. Mining Technol., vol. 7, No. 5, September 1943, Tech. Pub. 1614, 7 pp.

[53] Mactaggert, E. F., Radium Production: Chem. and Met. Eng., vol. 50, No. 7, July 1943, pp. 178–181; South African Min. and Eng. Jour., vol. 54, No. 2635, part 1, July 31, 1943, pp. 473–474.

[54] Northern Miner, B. E. A. R. to Offer Proposals: Vol. 29, No. 51, March 9, 1944, p. 14.

Work at the large radium-uranium deposit of Union Minière du Haut Katanga at Shinkolobwe, 10 miles southwest of Jadotville, Belgian Congo, was suspended in 1937 and apparently resumed in 1942, when the production was 1,021 metric tons of uranium ore containing 695.6 tons of U_3O_8. The company refinery at Oolen, Belgium, has been inaccessible to the United Nations since May 1940, but arrangements have been made to refine some Congo ore in Canada. The work of the Radium Institute of the Academy of Science of the U. S. S. R. "led to the discovery of new deposits of radioactive substances in the Soviet Union and laid the foundation of the extensive radium industry of the country"; the institute built the first cyclotron in Europe in 1937.[55] British-owned Companhia Portuguesa de Radium, Ltd., shipped 600 kilograms of radium salts [56] (estimated to contain 4.5 grams of radium) to United Kingdom in 1942. There was no Portuguese production of radium and uranium in 1943. Britain depends principally on Canadian supplies of radium, uranium, and mesothorium. The State-owned shale-oil plant at Kvarntorp, Province of Narke, Sweden, yields a residue containing uranium and other metals which may be extracted in future.[57] Exploration has revealed 25,000 tons of uranium ore (2 percent U) at Goten, 13 miles northeast of Sofia, Bulgaria.[58]

RHENIUM

Flue dust obtained from roasting domestic molybdenum ore has been found by A. D. Melaven and J. A. Bacon of the University of Tennessee to contain 1–1.5 percent rhenium in readily recoverable form.[59] The metal was first isolated in 1925 in Germany, and the few pounds produced in that country before World War II had constituted the total world output known hitherto. Rhenium is ductile, high-melting, and dense and has been used in catalysts, filaments, pen points, and electrical contacts.

SELENIUM AND TELLURIUM

Domestic production.—Selenium production increased 26 percent in 1943 compared with 1942, establishing a new record; producers' shipments climbed 65 percent but did not reach the 1941 level. Tellurium production in 1943 was only a fourth of that in 1942, and sales dropped 37 percent to pre-war levels. Stocks remained large. Producers of refined selenium and tellurium are the American Smelting & Refining Co., International Smelting & Refining Co., United States Metals Refining Co., and United States Smelting, Refining and Mining Co. Silver slimes containing selenium and tellurium are produced by Phelps Dodge Refining Corporation. All the selenium and most of the tellurium refined come from the tank slimes of electrolytic copper refineries; some tellurium is a byproduct of lead.

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[55] Monsaroff, B. (translator), Chemistry in Soviet Russia: Canadian Chem. & Process Ind., vol. 27, No. 12, December 1943, p. 710.

[56] Mining Journal (London), vol. 221, No. 5649, Nov. 27, 1943, p. 323.

[57] Metal Bulletin (London), No. 2686, April 21, 1942, p. 8.

[58] Kostov, Ivan, Metallization of the Balkan Peninsula: Mining Mag. (London), vol. 68, No. 5, May 1943, pp. 261-274.

[59] Science News Letter, Rare Chemical Element Found in Dust from Flues: Vol. 43, No. 17, April 24, 1943, p. 265.

Salient statistics of elemental selenium and tellurium in the United States, 1939–43

Year	Selenium					Tellurium [1]		
	Production (pounds)	Producers' sales [2] (pounds)	Producers' stocks at end of year (pounds)	Imports [3]		Production (pounds)	Producers' sales [2] (pounds)	Producers' stocks at end of year (pounds)
				Pounds	Value			
1939	227,131	345,726	246,800	124,830	$193,168	25,234	63,431	39,100
1940	328,731	368,709	206,800	134,429	198,163	85,622	88,996	35,700
1941	620,493	681,650	146,000	197,873	288,161	224,639	239,983	20,400
1942	506,426	316,613	341,900	83,666	127,004	224,132	98,798	145,700
1943	635,581	521,779	455,677	81,720	142,032	56,174	62,260	139,403

[1] Includes tellurium content of small quantity of oxide.
[2] Bureau of Mines not at liberty to publish value. Quantities for 1942–43 represent producers' shipments.
[3] Includes selenium salts.

Foreign trade.—All selenium imports in 1942–43 came from Canada, except a few hundred pounds from the United Kingdom. Tellurium is not shown separately in import statistics. Producers reported exporting 7,218 pounds of selenium (including Se content of compounds) and 233 pounds of tellurium in 1943 compared with 5,550 pounds of selenium and 150 pounds of tellurium in 1942. Dealers may have exported additional quantities.

Prices.—The nominal price of selenium (black, powdered, 99.5 percent) and of tellurium continued to be $1.75 a pound throughout 1943, according to E&MJ Metal and Mineral Markets. Barium selenite and sodium selenite were quoted at $1.40–$1.65 a pound by Glass Industry.

Uses.—Selenium is used to decolorize clear glass, make rectifiers,[60] and improve the machinability of stainless steels, copper alloys, and "invar."[61] Cadmium sulfoselenide red pigments are used in signal lenses and, before the cadmium shortage, in many other products. Most of the tellurium supply and some selenium are added to rubber cable coverings to promote resistance to heat, oxidation, and abrasion and to increase resilience. Tellurium-lead work-hardens and is resistant to acids.

Foreign production.—Canada produced 380,200 pounds (preliminary figure) of selenium in 1943 compared with 495,369 pounds in 1942 and 406,930 pounds in 1941. The Dominion's tellurium output was 61,300 pounds (preliminary figure) in 1943 compared with 11,084 pounds in 1942 and 11,453 pounds in 1941. The principal producer is Canadian Copper Refiners, Ltd. (subsidiary of Noranda Mines, Ltd.), Montreal East, Quebec; and the other is Ontario Refining Co. (subsidiary of International Nickel Co. of Canada, Ltd.), Copper Cliff, Ontario. The former company expanded its selenium-recovery facilities in 1944. A similar expansion was completed by the Boliden Mining Co., Sweden, in 1943.

THALLIUM

Thallium output was increased somewhat in 1943 by the sole domestic producer, the American Smelting & Refining Co., which recovers the metal as a byproduct of cadmium operations at Denver, Colo., and converts most of it to sulfate—an odorless, tasteless poison used in rodent and ant control. Thallium sulfate requirements of the Fish and Wildlife Service and cooperative organizations were about 10,000 pounds in 1943 (compared with 7,500 in 1942 and 3,500 in 1941), and private companies wanted at least an additional 3,000 pounds, but in view of the interruption of imports from Europe, supply was only one-third of demand. Thallium metal is quoted at $10 a pound by E&MJ Metal and Mineral Markets. The sulfate (99 percent) has been listed at $12.50 a pound by Oil, Paint and Drug Reporter since September 1942, before which it was $5–$7 a pound.

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[60] Kotterman, C. A., and Pollack, E. H., Selenium Rectifiers: Iron and Steel Eng., vol. 20, October 1943, pp. 73-81; abs. Metals and Alloys, vol. 19, No. 1, January 1944, pp. 162, 166.
[61] Steel, Low-Expansion Alloy Made Free-Machining: Vol. 112, No. 26, June 28, 1943, pp. 90, 92.

ZIRCONIUM

Domestic production.—Marketable zircon production in the United States totaled several hundred tons in 1940–43 compared with no output in 1929–39 and 3,646 short tons in 1927. The principal domestic producer at present is the Riz Mineral Co., which operates a concentrator at Melbourne, Brevard County, Fla.; the ore feed is black sand—formerly from stretches of beach near Melbourne but now from dunes about 3 miles inland from Vero Beach, Indian River County. St. Johns River Lumber & Development Co., St. Augustine, St. Johns County, Fla., shipped a small quantity of mixed ilmenite-rutile-zircon concentrates in 1943. Two companies produced crude zircon concentrates in 1943 for bringing up to marketable grade at a later date—Rutile Mining Co. of Fla. (subsidiary of Titanium Alloy Manufacturing Co.), as a byproduct of rutile and ilmenite from sand dunes between Jacksonville, Duval County, Fla., and the Atlantic coast; and Southwestern Engineering Co. (agent for Government-owned Metals Reserve Co.), as a byproduct of chromite from beach sands in Coos County, Oreg. The Oregon output was 2,143 short tons, averaging 27 percent ZrO_2. Beach deposits in Santa Rosa, Escambia, and Okaloosa Counties near Pensacola, Fla., are estimated to contain 750,000 tons of material averaging 1.2 percent kyanite, 1.0 percent ilmenite, 0.4 percent zircon, and 0.1 percent rutile.

Foreign trade.—Imports of zirconium concentrates are shown in the following table. There were no imports of zirconium ferroalloys in 1941–43. Exports in 1943 comprised 94 short tons ($7,805) of zirconium concentrates, 90 tons ($23,579) of alloys and metal, and 211 tons ($66,310) of compounds.

Zirconium concentrates imported for consumption in the United States, 1939–43, by countries, in short tons[1]

Year	Zircon from—				Baddeleyite from Brazil	Accessory titanium minerals[2]	Total zirconium concentrates[3]	
	Australia	Brazil	India	Total			Short tons	Value
1939	1,526	(4)	241	1,767	[4] 706	960	3,433	$49,919
1940	7,387	(4)	3,609	10,996	[4] 1,591	4,258	16,845	252,749
1941	14,689	(4)	963	15,652	[4] 5,002	7,020	27,674	604,744
1942	11,145	----------	196	11,341	15,283	7,282	33,906	816,364
1943	11,472	110	----------	11,582	8,821	8,009	28,412	697,704

[1] Totals and country break-down by the U. S. Department of Commerce. Mineral break-down by Bureau of Mines.
[2] Rutile and ilmenite content of mixed zirconium-titanium concentrates imported from Australia.
[3] Classified as "ore" by U. S. Department of Commerce.
[4] Zircon imports from Brazil, 1939–41, included with baddeleyite.

Consumption and uses.—Zircon shipments to consumers were 8,954 tons in 1943 compared with 5,766 tons in 1942. Zircon is used in ceramics, chiefly as an opacifier in porcelain enamels and pottery glazes but also as a constituent of refractories, electrical and chemical porcelains, grinding balls, and resistant glasses. Zirconia is advantageous in electrical heating units because it is both a conductor of heat and an insulator of electricity. Zircon refractories line many aluminum remelt furnaces. One of the largest uses of zircon is as a foundry sand. Zirconyl sulfate is a white tanning agent comparable with or superior to chrome.[62] Zirconium metal, the most explosive metal powder,[63] is used in radio tubes,[64] blasting caps, and flares.

Stocks.—Distributors' stocks of zircon (including zircon content of zirconium-titanium concentrates) were 8,197 short tons at the end of 1943 compared with 6,705 in 1942 and 6,549 in 1941. Government-owned Metals Reserve Co. stocks were 5,040 tons of zircon and 14,599 tons of baddeleyite at the end of 1943 compared with 4,500 tons and 4,156 tons, respectively, at the end of 1942. Large zircon stocks have resulted primarily from the strong demand for rutile, imported as mixed zircon-rutile-ilmenite concentrates from Australia.

Prices.—Zirconium ore, 55 percent ZrO_2, f. o. b. Atlantic seaboard, was quoted nominally at \$60–\$70 a short ton in January to March 1943, \$70–\$80 in early April, and \$65–\$75 from late April to the end of the year, according to E&MJ Metal and Mineral Markets. Glass Industry listed refined zircon at 6½ cents a pound in January to July 1942, 5¾ cents from August 1942 to January 1943, and 3½ cents after February. Zirconium ferrosilicon continued to be quoted at \$102.50–\$107.50 a long ton for 12- to 15-percent Zr content and 14–16 cents a pound for 35–40 percent Zr; and powdered zirconium metal at \$7 a pound.

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[62] Somerville, I. C., and Turley, H. G., Zirconium Tannage: Jour. Am. Leather Chemists Assoc., vol. 37, No. 8, August 1942, pp. 381–397; No. 12, December 1942, pp. 624–627; vol. 38, No. 9, September 1943, pp. 328–332.

[63] Hartmann, Irving, Nagy, John, and Brown, Hylton R., Inflammability and Explosibility of Metal Powders: Bureau of Mines Rept. of Investigations 3722, 1943, 44 pp.

[64] Raynor, W. M., Zirconium—An Abundant "Rare" Metal: Foote-Prints, vol. 15, No. 2, Summer 1943, pp. 3–10.

PART III. (NONMETALS)

BITUMINOUS COAL AND LIGNITE[1]

By W. H. Young, R. L. Anderson, and L. H. Isaac

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SURVEY OF THE BITUMINOUS-COAL AND LIGNITE INDUSTRY IN 1943

The production of soft coal reached a new all-time high in 1943, with an estimated output of 589,000,000 net tons compared with the previous peak of 582,692,937 net tons in 1942. Although production was the greatest on record it still was not sufficient to meet the demand created by the expanding war economy. There were several interruptions to production due to labor difficulties. According to the Bureau of Labor Statistics there were 400 strikes in soft-coal mines in 1943, with 487,474 workers involved, 7,510,377 man-days lost, and an average of 15 days lost per man. It is estimated that the loss in production due to labor difficulties amounted to 35,000,000 net tons. Other causes for loss of production included difficulty in obtaining supplies and machinery and shortage of men. However, the loss of men was offset, in part, by increases in working time. By January 1943, with a few exceptions, the 6-day week was in effect throughout the industry. On November 3, 1943, a new wage contract was signed, extending the working time to 8 hours per day.

Production.—The outstanding feature related to the production of 589,000,000 net tons in 1943 was the elimination of seasonal declines, due largely to the Government program urging consumers to build up stocks during the summer. Throughout most of the year production remained near 12,000,000 net tons per week, except when output was reduced because of labor difficulties.

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[1] Data for 1943 are preliminary; detailed statistics with final revisions will be released later. Data for 1942 are final. Information compiled in cooperation with the Solid Fuels Administration for War.

Consumption.—Although most of the major classes of consumers used more coal in 1943 than in 1942, there were certain exceptions; for instance, beehive ovens, coal-gas retorts, and cement mills burned less coal in 1943 than in 1942. Table 7 shows trends in consumption for the major classes of consumers.

Changes in stocks.—Owing to the shortage of coal, the reserve supply in the hands of industrial consumers and retail coal yards declined from a total of 85,889,000 net tons at the beginning of 1943 to 56,686,000 net tons at the close. The days' supply of stocks dropped from 51 to 30. Between the same periods stocks on the upper Lake docks declined 1,363,620 net tons, while unbilled coal in cars at the mines or classification yards fell 95,700 net tons.

Distribution.—Shipments of bituminous coal and lignite during 1943 showed only slight changes above or below the 1942 level in each of the primary channels of distribution. Table 12 shows trends in distribution of bituminous coal for 1937–43. Changes in the monthly volume of the more important movements are shown in figure 9.

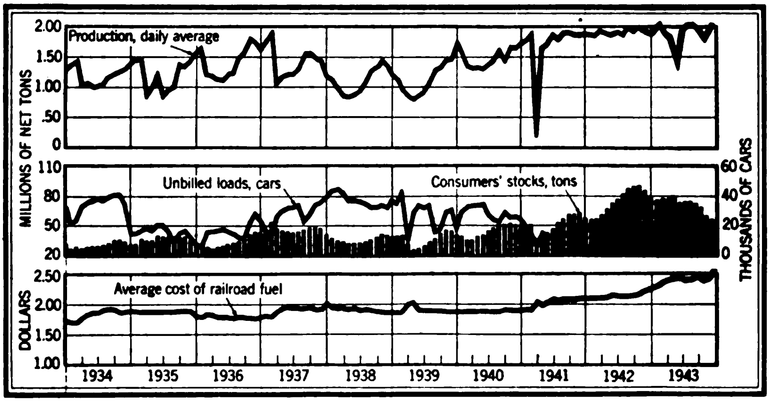

FIGURE 1.—Trends of production, stocks, and prices of bituminous coal and lignite in the United States 1934–43.

Mechanization.—The quantity of coal loaded mechanically at underground mines in the United States continued to advance during 1943. Preliminary estimates show that mechanical loading increased from 39.6 percent of the total output in 1942 to 42.4 percent in 1943, even though sales of underground loading equipment, in terms of capacity, were 32 percent less than in 1942.

Mechanical cleaning.—The total capacity of mechanical-cleaning equipment sold for use at bituminous-coal mines in 1943 was estimated at 3,500 net tons of cleaned coal per hour as compared with 6,400 net tons in 1942.

Trend of employment.—An estimate of the average number of men employed at bituminous-coal and lignite mines in 1943 indicates a sharp drop to 428,000 men from 461,991 in 1942.

Index to capacity.—The potential output upon a 308-day basis was 730,000,000 net tons in 1942. Under the 5-day week, full-time operation is limited to approximately 261 days. The average output per working day was 2,368,670 net tons during 1942, which (if applied to 261 days) gives an annual potential output of 618,000,000 tons compared with the actual total production of 582,692,937 net tons.

Trend of fuel efficiency.—For many years before 1942 there was a steady trend toward increased fuel efficiency. During 1942 and 1943 this trend was arrested or reversed, and some industries exhibited decreased fuel efficiency (see table 8).

Competition of oil and gas.—In 1943, as in 1942, competition among the various fuels was far outweighed by the urgent need for sufficient production of all fuels to satisfy the continued increase in demand.

Electric power utilities consumed 17 percent more bituminous coal, 18 percent more fuel oil, and 28 percent more gas in 1943 than in 1942.

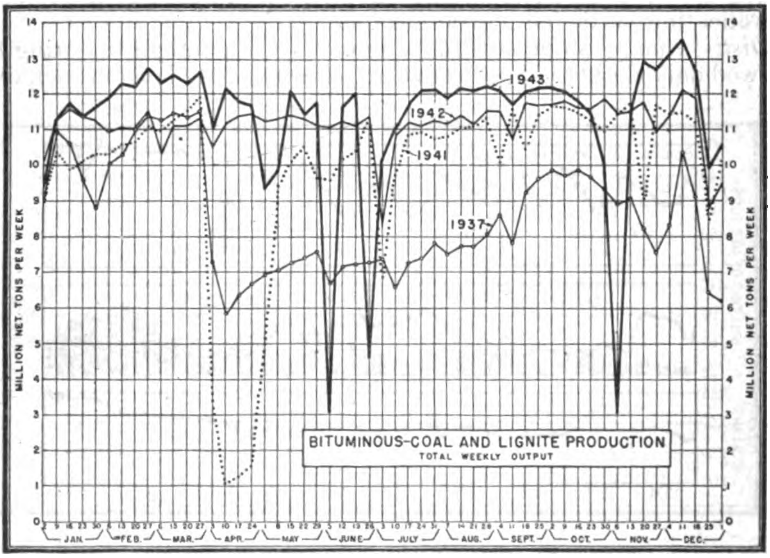

FIGURE 2.—Production of bituminous coal and lignite in the United States, by weeks, 1937 and 1941–43.

Class 1 railroads increased their consumption of coal by 13 percent in 1943 and their purchases of fuel oil by 16 percent over 1942.

Further curtailment of the manufacture of domestic fuel-burning equipment is reflected by statistics published by the Bureau of the Census. Factory sales of domestic stokers were reduced from 62,753 in 1942 to 4,460 in 1943; shipments of domestic oil burners, boiler-burner units, and furnace-burner units decreased from 82,388 in 1942 to 27,956 in 1943.

SOURCES OF DATA

Bituminous-coal and lignite production statistics for 1943 are preliminary estimates based upon (1) weekly or monthly reports of railroad carloadings of coal and beehive coke by all the important carriers, (2) shipments by river as reported by the United States Army Engineers, (3) direct reports from a number of mining companies, and (4) monthly production statements compiled by a number of local operators' associations and State mine departments. In the

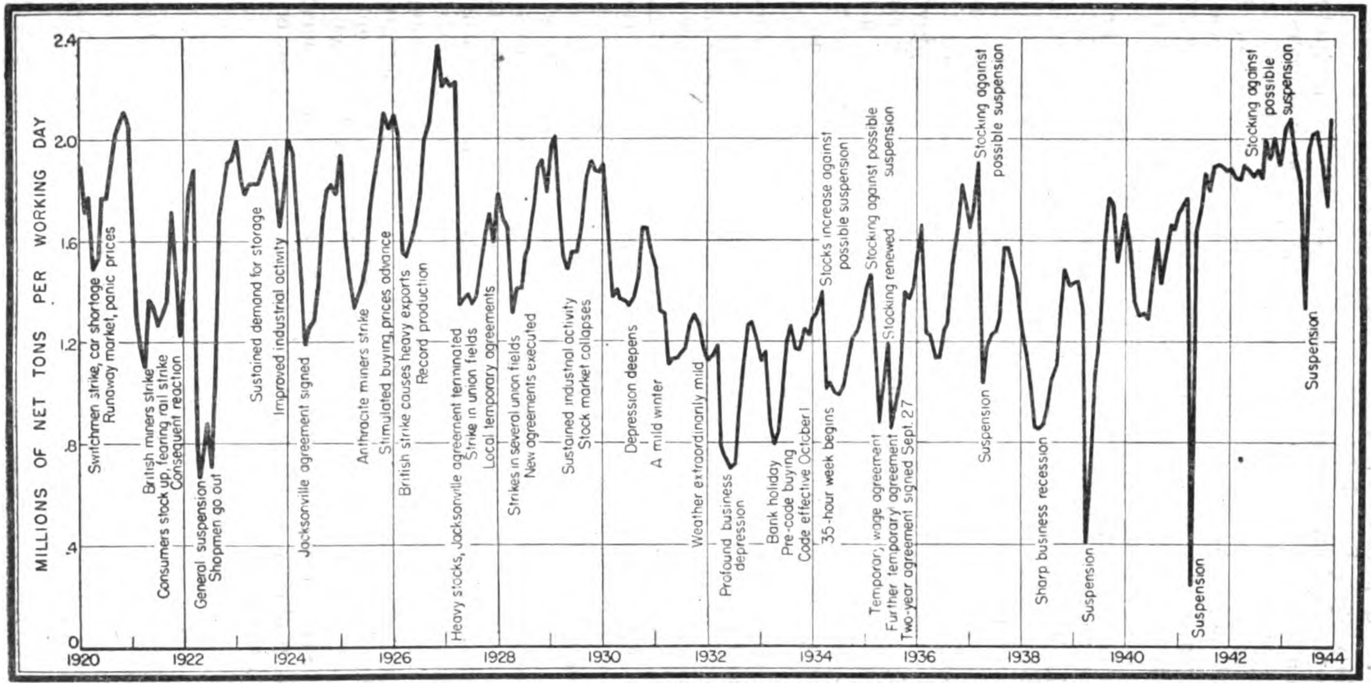

FIGURE 3.—Average production of bituminous coal and lignite in the United States per working day in each month, 1920–43.

estimates for 1943, allowance has been made for commercial truck shipments, local sales and colliery fuel, and small trucking or wagon mines producing over 1,000 tons a year.

Data for 1942 are final and are based upon detailed annual reports of production and mine operation furnished by the producers. As in previous years, all but a small percentage of the output was covered by the reports submitted. For the remaining output not directly reported, consisting chiefly of small mines, it has been possible to obtain reasonably accurate data from the records of the State mine departments, which have statutory authority to require such reports, or, in a few instances, from railroad carloadings.

Final figures of output and employment obtained from the annual canvass of production as shown in this report for 1942 differ slightly from those obtained from the annual canvass of accidents as published March 29, 1944, in Mineral Industry Surveys HSS 333. According to the production canvass, the output was 582,692,937 net tons and average number of men employed amounted to 461,991, while, according to the accident canvass of soft-coal mines, the production was 581,704,840 net tons and average men employed was 448,797. There are two major causes for this slight discrepancy in the two series of data. First, the coverage was not identical; that is, some mines were covered by the production canvass and not covered by the accident canvass, and vice versa. On an over-all basis, the production canvass included 6,972 mines, whereas the accident canvass included 6,940 mines. Since the question on production was asked in substantially the same form on both canvasses, the discrepancy in output figures is due largely to the difference in coverage, while the discrepancy in employment is due partly to other causes. Second, producers reported for identical mines different figures of output and employment on the production canvass from those reported on the accident canvass. Although this cause is only slightly responsible for the discrepancy in the output figures, it is very significant in explaining the discrepancy in the employment series. The principal reason for the producers reporting different figures of employment for the same mine was that the question on employment on the production canvass was asked in a slightly different form to the way it was in the accident canvass. The wording of the question on employment in the production canvass tends to count the employee who works only part of the year and at the same time not give complete consideration to absenteeism. Since the employment series from the accident canvass tends to discount the employee who leaves the industry during the year as well as discount absenteeism, this figure is probably a better measure of changes of manpower in the soft-coal industry.

SALIENT STATISTICS

TABLE 1.—*Salient statistics of the bituminous-coal and lignite industry in the United States, 1942–43*

[All tonnage figures represent net tons]

	1942	1943 (preliminary)	Change in 1943
			Percent
Production	582, 692, 937	589, 000, 000	+1.1
Consumption in the United States [1]	540, 629, 000	594, 552, 000	+10.0
Stocks at end of year:			
Industrial consumers and retail yards	85, 889, 000	56, 686, 000	−34.0
Stocks on upper Lake docks	6, 993, 030	5, 629, 410	−19.5
Unbilled loads, at mines or in classification yards [2]	139, 700	44, 000	−68.5
Price indicators (average per net ton):			*Cents*
Average cost of railroad fuel purchased, f. o. b. mines [3]	$2.13	$2.42	+29
Average cost of coking coal at merchant byproduct ovens [4]	$4.98	$5.21	+23
Average retail price—35 cities [5]	$9.53	$9.94	+41
Average railroad freight charge per net ton [6]	$2.31	$2.30	−1
Underground loading machinery sold: [7]			*Percent*
Mobile loading machines (number)	352	234	−33.5
Scrapers (number)	15	13	−13.3
Pit-car loaders (units)	2	1	−50.0
Conveyors, including those with duckbills (units)	1, 167	798	−31.6
Average number of men employed at mines operating [8]	461, 991	428, 000	−7.4
Fuel-efficiency indicators:			
Pounds of coal per kilowatt-hour at electric power plants [9]	1.31	1.31	....
Pounds per 1,000 gross ton-miles—railroads [10]	111	114	+2.7

[1] Represents certain classes of consumers only. See table 7 for consumers included.

[2] Association of American Railroads.

[3] Interstate Commerce Commission (class I steam railways, including class I switching and terminal companies). Excludes freight charges.

[4] As reported by coke operators.

[5] Bureau of Labor Statistics.

[6] Average receipts per net ton of revenue bituminous coal and lignite originated, as reported by the Interstate Commerce Commission.

[7] Young, W. H., Anderson, R. L., Lamb, G. A., and Buch, J. W., Mechanization Sales: Coal Age, February 1944, pp. 72–75, and Mining Congress Journal, February 1944, pp. 45–47.

[8] The figure for 1942 is based upon reports of mine operators producing over 1,000 tons. The figure for 1943 is estimated from various sources.

[9] Federal Power Commission.

[10] Interstate Commerce Commission; includes coal equivalent of fuel oil consumed.

PRODUCTION BY WEEKS AND MONTHS

The following tables summarize the preliminary statistics of weekly and monthly production of bituminous coal and lignite in 1943. The figures are estimates based upon daily and weekly statements of cars of coal and beehive coke loaded by the principal railroads and of shipments over the more important originating rivers. Allowance has been made for commercial truck shipments, local sales, and colliery fuel. The estimates given are based upon the latest information available and differ in some instances from the current figures previously published in the Weekly Coal Reports.

For the method used in counting holidays, see the chapter on Coal in Mineral Resources of the United States, 1930, page 631.

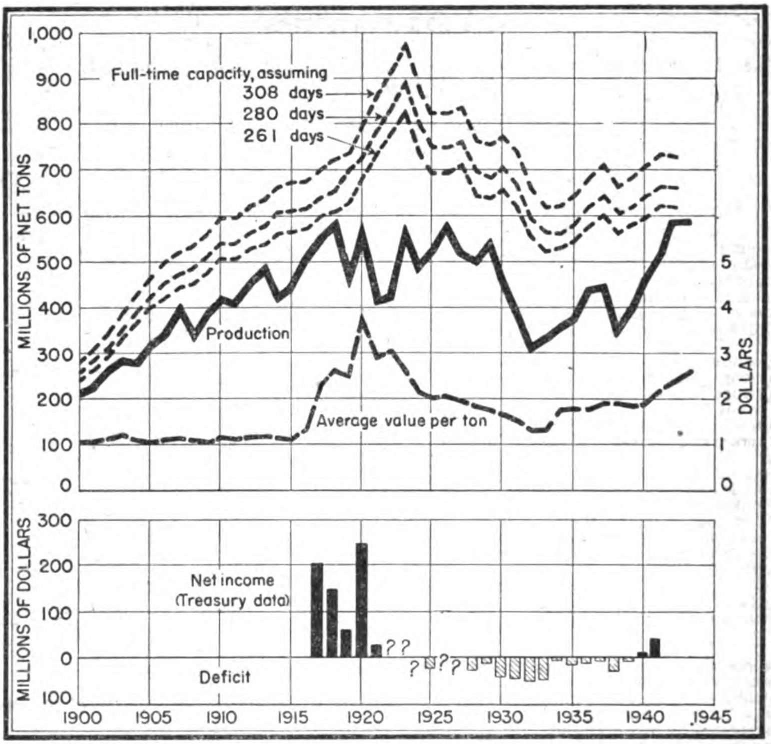

FIGURE 4.—Trends of bituminous-coal and lignite production, realization, mine capacity, and net income, or deficit in the United States, 1900-43

TABLE 2.—*Estimated weekly production of bituminous coal and lignite in the United States in 1943*

Week ended	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 2	[1] 1,744,000	[1] 1	[2] 1,896,000
Jan. 9	11,296,000	6	1,883,000
Jan. 16	11,745,000	6	1,958,000
Jan. 23	11,355,000	6	1,893,000
Jan. 30	11,664,000	6	1,944,000
Feb. 6	11,943,000	6	1,991,000
Feb. 13	12,273,000	6	2,046,000
Feb. 20	12,197,000	6	2,033,000
Feb. 27	12,718,000	6	2,120,000
Mar. 6	12,256,000	6	2,043,000
Mar. 13	12,523,000	6	2,087,000
Mar. 20	12,274,000	6	2,046,000
Mar. 27	12,599,000	6	2,100,000
Apr. 3	10,996,000	5.5	1,999,000
Apr. 10	12,170,000	6	2,028,000
Apr. 17	11,818,000	6	1,970,000
Apr. 24	11,647,000	6	1,941,000
May 1	9,413,000	6	1,569,000
May 8	9,930,000	6	1,655,000
May 15	12,097,000	6	2,016,000
May 22	11,429,000	6	1,905,000
May 29	11,756,000	6	1,959,000
June 5	3,015,000	5.8	520,000
June 12	11,651,000	6	1,942,000
June 19	12,007,000	6	2,001,000
June 26	4,606,000	6	768,000
July 3	10,165,000	6	1,694,000
July 10	11,076,000	5.7	1,943,000
July 17	11,712,000	6	1,952,000
July 24	12,090,000	6	2,015,000
July 31	12,113,000	6	2,019,000
Aug. 7	11,883,000	6	1,981,000
Aug. 14	12,150,000	6	2,025,000
Aug. 21	12,112,000	6	2,019,000
Aug. 28	12,242,000	6	2,040,000
Sept. 4	12,091,000	6	2,015,000
Sept. 11	11,660,000	5.7	2,046,000
Sept. 18	12,049,000	6	2,008,000
Sept. 25	12,180,000	6	2,030,000
Oct. 2	12,178,000	6	2,030,000
Oct. 9	12,086,000	6	2,014,000
Oct. 16	11,825,000	6	1,971,000
Oct. 23	11,467,000	6	1,911,000
Oct. 30	10,026,000	6	1,671,000
Nov. 6	3,061,000	6	510,000
Nov. 13	11,534,000	5.9	1,955,000
Nov. 20	12,974,000	6	2,162,000
Nov. 27	12,685,000	5.8	2,187,000
Dec. 4	13,132,000	6	2,189,000
Dec. 11	13,540,000	6	2,257,000
Dec. 18	12,702,000	6	2,117,000
Dec. 25	9,875,000	5	1,975,000
Jan. 1, 1944	[1] 9,270,000	[1] 5	[2] 1,842,000
	589,000,000	309.4	1,904,000

[1] Figures represent output and number of working days in that part of the week included in the calendar year shown. Total production for the week of Jan. 1, 1944, was 10,500,000 net tons; for the week of Jan. 2, 1943, was 9,479,000 net tons.

[2] Average daily production for the entire week and not for the working days in the calendar year shown.

TABLE 3.—*Estimated monthly production of coal in the United States, by States, in thousands of net tons, in 1943*

[Bituminous and lignite figures are preliminary estimates based on railroad carloadings and river shipments of coal and beehive coke, supplemented by direct reports from a number of mining companies, local coal operators' associations, and detailed monthly production statistics compiled by the State Mine Departments of Colorado, Illinois, Pennsylvania, Washington, and West Virginia. In making the estimates, allowance is made for commercial truck shipments, local sales, and colliery fuel, and for small trucking mines producing over 1,000 tons a year. Where a mine is on the border between two States, the production is accredited to the State from which the coal is extracted, rather than the State in which the tipple is located. The estimates here given differ in a few cases from the current figures previously published in the Weekly Coal Reports]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,591	1,520	1,682	1.378	1,616	924	1,693	1,655	1,604	983	1,429	1,675	17,750
Alaska	27	25	26	22	24	20	19	21	23	29	34	30	300
Arkansas and Oklahoma	431	432	469	318	249	267	398	377	390	398	337	424	4,490
Colorado	790	733	812	592	648	409	639	667	699	745	636	880	8,250
Georgia and North Carolina	3	3	3	3	3	3	4	3	3	4	3	3	38
Illinois	5.765	5.980	7,035	6,320	5,270	4,298	6,450	6,410	6.435	5,990	5,536	6,941	72,430
Indiana	2,158	2,084	2,345	2,250	1.780	1,548	2.220	2,290	2,390	1,680	1,990	2,440	25,175
Iowa	295	278	303	251	207	168	178	181	213	210	219	257	2,760
Kansas and Missouri	744	816	814	706	559	559	668	630	625	742	735	777	8,375
Kentucky:													
Eastern	3.758	3,898	4,450	3,842	3,950	2,655	4.355	4,110	4.148	3,754	3,440	4,126	46,486
Western	1.304	1,290	1.445	1,280	1,214	977	1,290	1,363	1,330	1,293	1,254	1,370	15,410
Maryland	132	155	190	172	153	127	171	167	158	147	128	150	1,850
Michigan	18	20	21	12	13	10	15	15	14	14	13	15	180
Montana (bituminous and lignite)	424	385	388	359	355	303	391	364	398	418	476	454	4,715
New Mexico	156	155	177	156	136	106	169	158	152	154	135	162	1.816
North and South Dakota (lignite)	313	267	210	115	114	120	153	137	189	277	333	340	2,568
Ohio	2,498	2,602	3,072	2,773	2,822	1,922	2,910	2,780	2,845	2,812	2,214	2,685	31,935
Pennsylvania (bituminous)	11.268	11.679	13,318	11,418	11.715	7,765	12,413	13,038	12,866	12,745	10,368	12,982	141,575
Tennessee	633	623	717	607	575	388	596	594	601	570	570	686	7,160
Texas (bituminous and lignite)	28	16	14	11	12	10	12	11	16	20	21	24	195
Utah	550	510	566	514	505	315	496	467	460	462	440	485	5,770
Virginia	1,602	1,660	1,845	1,665	1.635	1,200	1,835	1 720	1,700	1.540	1.420	1,678	19,500
Washington	140	146	155	129	130	92	130	125	126	123	90	140	1,526
West Virginia	12,307	13,047	15,181	13,576	13,031	9,706	14,275	14,441	14,050	13.356	12,110	14,540	159,620
Wyoming	868	806	875	750	700	492	725	707	778	835	710	864	9.110
Other Western States	1	1	1	1	1	1	2	1	1	2	2	2	16
Total bituminous and lignite	47.804	49,131	56,114	49,220	47,417	34,385	52,207	52,432	52,214	49.303	44,643	54,130	589.000
Pennsylvania anthracite [1]	4,443	5,176	5,824	5,309	5,192	3,227	5.668	5,624	5.445	5,331	4,118	4.970	60,327
Grand total	52,247	54,307	61,938	54.529	52,609	37,612	57,875	58,056	57.659	54,634	48,761	59,100	649,327

[1] Subject to revision. Includes Sullivan County, washery and dredge coal, local sales, colliery fuel, and coal shipped by truck from authorized operations.

TABLE 4.—*Estimated monthly production of bituminous coal and lignite in the United States, by districts, in thousands of net tons, in 1943*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto. Exclusive of mines producing less than 1,000 tons a year]

[Figures are based principally upon the records of railroad carloadings and river shipments of coal and beehive coke, supplemented by direct reports from certain local sources, which are used in estimating State production. Allowance is made for commercial truck shipments, local sales, and colliery fuel, and for trucking mines producing over 1,000 tons a year. These records are sufficient to permit estimating the total production of coal for the United States with a high degree of accuracy. To apportion the totals among the districts involves a larger measure of estimate and hence the district tonnages are subject to a larger measure of correction when final complete reports are received from all operators at the end of the year]

Minimum price area and producing district	January	February	March	April	May	June	July	August	September	October	November	December	Total
PRICE AREA 1													
Dist. 1. Eastern Pennsylvania[1]	4,484	4,870	5,579	4,875	4,831	3,276	5,394	5,670	5,471	5,238	4,338	5,484	59,510
Dist. 2. Western Pennsylvania	6,986	7,038	8,011	6,785	7,110	4,678	7,271	7,600	7,640	7,730	6,237	7,746	84,832
Dist. 3. Northern West Virginia	3,079	3,314	3,802	3,284	3,323	2,570	3,598	3,802	3,716	3,383	3,433	3,998	41,302
Dist. 4. Ohio	2,498	2,602	3,072	2,773	2,822	1,922	2,910	2,780	2,845	2,812	2,214	2,685	31,935
Dist. 5. Michigan	18	20	21	12	13	10	15	15	14	14	13	15	180
Dist. 6. Panhandle	379	381	552	452	405	298	416	438	412	437	373	621	5,164
Dist. 7. Southern numbered 1	4,961	5,265	6,170	5,590	5,269	3,955	5,622	5,931	5,626	5,357	4,543	5,549	63,838
Dist. 8. Southern numbered 2	9,666	10,048	11,420	10,152	9,987	6,972	11,205	10,489	10,518	9,833	8,979	10,604	119,873
Total, price area 1	32,071	33,538	38,627	33,923	33,760	23,681	36,431	36,725	36,242	34,804	30,130	36,702	406,634
PRICE AREA 2													
Dist. 9. West Kentucky	1,304	1,290	1,445	1,280	1,214	977	1,290	1,363	1,330	1,293	1,254	1,370	15,410
Dist. 10. Illinois	5,765	5,980	7,035	6,320	5,270	4,298	6,450	6,410	6,435	5,990	5,536	6,941	72,430
Dist. 11. Indiana	2,158	2,084	2,345	2,250	1,780	1,548	2,220	2,290	2,390	1,680	1,990	2,440	25,175
Dist. 12. Iowa	295	278	303	251	207	168	178	181	213	210	219	257	2,760
Total, price area 2	9,522	9,632	11,128	10,101	8,471	6,991	10,138	10,244	10,368	9,173	8,999	11,008	115,775
PRICE AREA 3													
Dist. 13. Southeastern	1,739	1,669	1,852	1,523	1,753	1,019	1,836	1,798	1,747	1,121	1,565	1,838	19,460
PRICE AREA 4													
Dist. 14. Arkansas-Oklahoma	258	259	282	190	149	160	233	226	233	258	202	259	2,709
PRICE AREA 5													
Dist. 15. Southwestern:													
Bituminous	919	991	1,004	834	661	668	836	783	785	883	872	943	10,179
Lignite (Texas)	26	14	11	11	10	8	9	9	13	19	19	23	172
Total, price area 5	945	1,005	1,015	845	671	676	845	792	798	902	891	966	10,351

PRICE AREA 6													
Dist. 16. Northern Colorado	299	246	279	139	156	103	124	165	233	292	225	329	2,590
Dist. 17. Southern Colorado [2]	589	580	636	546	568	365	618	599	560	548	495	647	6,751
Dist. 18. New Mexico [3]	59	63	75	63	60	47	66	61	58	59	52	67	730
Total, price area 6	947	889	990	748	784	515	808	825	851	899	772	1,043	10,071
PRICE AREA 7													
Dist. 19. Wyoming [4]	868	806	875	750	700	492	725	707	778	835	710	864	9,110
Dist. 20. Utah	550	510	566	514	505	315	496	467	460	462	440	485	5,770
Total, price area 7	1,418	1,316	1,441	1,264	1,205	807	1,221	1,174	1,238	1,297	1,150	1,349	14,880
PRICE AREA 8													
Dist. 21. North-South Dakota (lignite)	313	267	210	115	114	120	153	137	189	277	333	340	2,568
PRICE AREA 9													
Dist. 22. Montana (bituminous and lignite)	424	385	388	359	355	303	391	364	398	418	476	454	4,715
PRICE AREA 10													
Dist. 23. Washington [5]	140	146	155	130	131	93	132	126	127	125	91	141	1,537
Alaska	27	25	26	22	24	20	19	21	23	29	34	30	300
Total, price area 10	167	171	181	152	155	113	151	147	150	154	125	171	1,837
Grand total [6]	47,804	49,131	56,114	49,220	47,417	34,385	52,207	52,432	52,214	49,303	44,643	54,130	589,000

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[1] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[2] Includes Colfax County, N. Mex.

[3] Includes Arizona and California, but excludes Colfax County, N. Mex.

[4] Includes Idaho.

[5] Includes Oregon.

[6] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and anthracite and semianthracite outside of Pennsylvania.

TABLE 5.—*Average value per ton, f. o. b. mines, of bituminous coal and lignite in the United States, by States, 1942–43* [1]

State	1942	1943 (preliminary)	State	1942	1943 (preliminary)
Alabama	$2.87	$3.30	North and South Dakota (lignite)	$1.41	$1.49
Alaska	6.22	7.10	Ohio	2.10	2.42
Arkansas	3.80	4.08	Oklahoma	2.84	2.93
Colorado	2.86	3.27	Pennsylvania	2.48	2.80
Georgia	3.28	3.30	Tennessee	2.54	2.92
Illinois	1.91	2.11	Texas (bituminous and lignite)	.99	1.35
Indiana	1.78	2.06	Utah	2.59	2.90
Iowa	2.85	3.05	Virginia	2.59	2.88
Kansas	2.19	2.50	Washington	3.87	4.38
Kentucky	2.36	2.60	West Virginia	2.42	2.82
Maryland	2.60	2.92	Wyoming	2.20	2.30
Michigan	4.42	4.74	Other States [2]	2.93	4.25
Missouri	2.38	2.50			
Montana (bituminous and lignite)	1.63	1.71	Total	2.36	2.66
New Mexico	3.15	3.64			

[1] Average gross realization, selling cost not deducted.
[2] Includes Arizona and Oregon.

TABLE 6.—*Average value per ton, f. o. b. mines, of bituminous coal and lignite in the United States, by districts, 1942–43* [1]

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	1942	1943 (preliminary)
PRICE AREA 1		
Dist. 1. Eastern Pennsylvania [2]	$2.54	$2.92
Dist. 2. Western Pennsylvania	2.44	2.73
Dist. 3. Northern West Virginia	2.12	2.45
Dist. 4. Ohio	2.10	2.42
Dist. 5. Michigan	4.42	4.74
Dist. 6. Panhandle	2.14	2.35
Dist. 7. Southern numbered 1	2.73	3.12
Dist. 8. Southern numbered 2	2.44	2.81
Total, price area 1	2.44	2.79
PRICE AREA 2		
Dist. 9. West Kentucky	1.70	1.96
Dist. 10. Illinois	1.91	2.11
Dist. 11. Indiana	1.78	2.06
Dist. 12. Iowa	2.85	3.05
Total, price area 2	1.88	2.10
PRICE AREA 3		
Dist. 13. Southeastern	2.85	3.30
PRICE AREA 4		
Dist. 14. Arkansas-Oklahoma	3.75	4.08
PRICE AREA 5		
Dist. 15. Southwestern:		
Bituminous	2.35	2.50
Lignite (Texas)	.85	.88
Total, price area 5	2.31	2.48
PRICE AREA 6		
Dist. 16. Northern Colorado	2.71	2.98
Dist. 17. Southern Colorado [3]	2.94	3.43
Dist. 18. New Mexico [4]	3.41	3.94
Total, price area 6	2.91	3.34
PRICE AREA 7		
Dist. 19. Wyoming [5]	2.20	2.30
Dist. 20. Utah	2.59	2.90
Total, price area 7	2.36	2.53

See footnotes at end of table.

TABLE 6.—*Average value per ton, f. o. b. mines, of bituminous coal and lignite in the United States, by districts, 1942–43* [1]—Continued

Minimum price area and producing district	1942	1943 (preliminary)
PRICE AREA 8		
Dist. 21. North-South Dakota (lignite)	$1.41	$1.49
PRICE AREA 9		
Dist. 22. Montana (bituminous and lignite)	1.63	1.71
PRICE AREA 10		
Dist. 23. Washington [6]	3.87	4.38
Alaska	6.22	7.10
Total, price area 10	4.14	4.82
Grand total [7]	2.36	2.66

[1] Average gross realization, selling cost not deducted.
[2] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.
[3] Includes Colfax County, N. Mex.
[4] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.
[5] Includes Idaho. No production was reported for Idaho.
[6] Includes Oregon.
[7] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

CONSUMPTION

TABLE 7.—*Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1934–43, in thousands of net tons* [1]

Year	Colliery fuel	Electric power utilities [2]	Railroads (class I) [3]	Coke		Steel and rolling mills	Coal-gas retorts	Cement mills	Other industrials [4]	Retail-dealer deliveries	Total of classes shown
				Beehive ovens	By-product ovens						
1934	3, 175	31, 835	76, 037	1, 635	44, 343	10, 898	2, 475	3, 500	83, 798	86, 925	344, 621
1935	3, 103	33, 013	77, 109	1, 469	49, 046	11, 747	2, 245	3, 516	91, 589	83, 990	356, 827
1936	3, 227	40, 029	86, 391	2, 698	63, 244	13, 471	1, 945	4, 771	108, 620	84, 200	408, 596
1937	3, 052	42, 871	88, 080	4, 927	69, 575	12, 853	1, 680	5, 247	122, 410	80, 076	430, 771
1938	2, 493	38, 245	73, 921	1, 360	45, 266	8, 412	1, 644	4, 483	92, 390	68. 520	336, 734
1939	2, 565	43, 979	79, 072	2, 298	61, 216	9, 808	1, 614	5, 274	98, 900	71, 570	376, 296
1940	2, 443	50, 973	85, 130	4, 803	76, 583	10, 040	1, 746	5, 633	106, 280	87, 700	431, 331
1941	2, 489	61, 861	97, 384	10, 529	82, 609	10, 902	1, 659	6, 832	120, 720	97, 460	492, 445
1942	2, 708	65, 636	115, 410	12, 876	87, 974	10, 434	1, 721	7, 570	131, 550	104, 750	540, 629
1943 [5]	2, 739	76, 401	130, 283	12, 441	90, 019	11, 238	1, 605	5, 851	141, 211	122, 764	594, 552

[1] These data have been assembled to show changes in consumption of bituminous coal and lignite by such classes of consumers as report currently. The total, including retail deliveries, does not represent grand total consumption in the United States. Bunker-fuel statistics are not available for publication at present. The "total of classes shown" for each year in the above table cannot be reconciled with the calculated consumption obtained by the formula: "Production plus imports minus exports plus or minus net changes in consumers' stocks" due to the omission of bunker fuel; to revisions in data covering production, exports, and imports; and to unavoidable irregularities that occur in reports from respondents who are unable to require that definitions applied and closing dates observed by their accountants are identical with those generally used in the surveys of bituminous-coal and lignite consumption.
[2] Geological Survey and Federal Power Commission. Represents bituminous coal and lignite consumed by public utility power plants in power generation, including a small quantity of coke amounting to approximately 100,000 tons annually.
[3] Association of American Railroads. Represents the consumption of bituminous coal and lignite by class I railways, for all uses, including locomotive, powerhouse, shop, and station fuel. The Interstate Commerce Commission reports that in 1942 the consumption for all uses by class I line-haul railways plus the purchases for class II and class III railways, plus purchases by all switching and terminal companies combined, was 122,208,266 net tons of bituminous coal and lignite. Similar data from the Interstate Commerce Commission are not yet available for 1943.
[4] Estimates based upon reports collected by the Solid Fuels Administration for War from a selected list of representative manufacturing plants.
[5] Subject to revision.

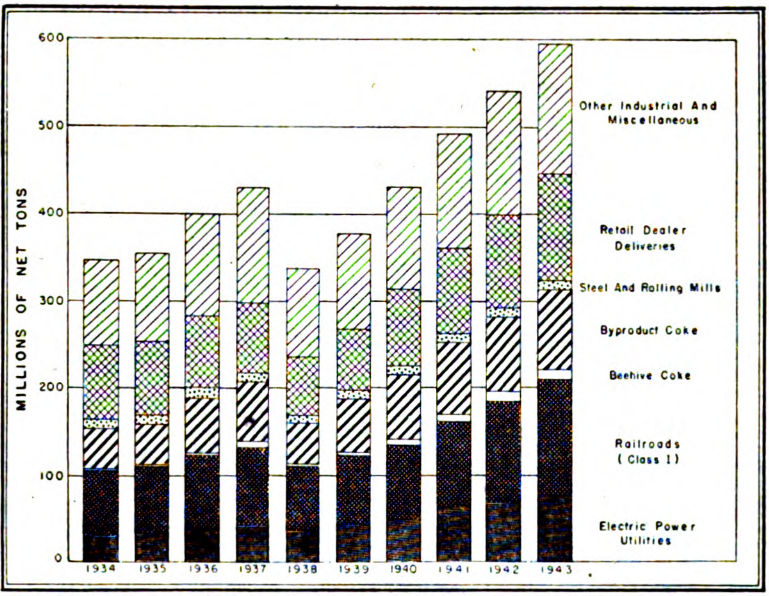

FIGURE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1934–43.

FUEL EFFICIENCY

TABLE 8.—*Indicators of effect of fuel economy on consumption of coal in the United States per unit of performance since the World War of 1914–18*

	Pounds	Reduction from base period (percent)
Steam railroads:		
Pounds per 1,000 gross ton-miles freight service:		
Average:		
1919–20	170	
1942	111	34.7
1943	114	32.9
Pounds per passenger-train car-mile:		
Average:		
1919–20	18.5	
1942	15.1	18.4
1943	15.0	18.9
Electric public-utility power plants:		
Pounds per kilowatt-hour:		
1919	3.2	
1942	1.3	59.4
1943	1.3	59.4
Iron and steel-pounds coking coal per net ton of pig: [1]		
1918	3,194	
1942	2,604	18.5
1943	2,620	18.0
Coke manufacture: Savings of heat values through recovery of gas, tar, light oils, and breeze by extension of byproduct in place of beehive coking, 1913–43, expressed as percent of coal used for all coke in 1943 [2]		18.5

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[1] Includes only savings through higher yields of merchantable coke per ton of coal charge and lower consumption of coke per ton of iron. Excludes economies through recovery of byproducts, which are covered in next item.

[2] These byproducts are used in part for boiler fuel, in part for metallurgical purposes, in part for domestic heating and coking, and to a small extent for automotive fuel.

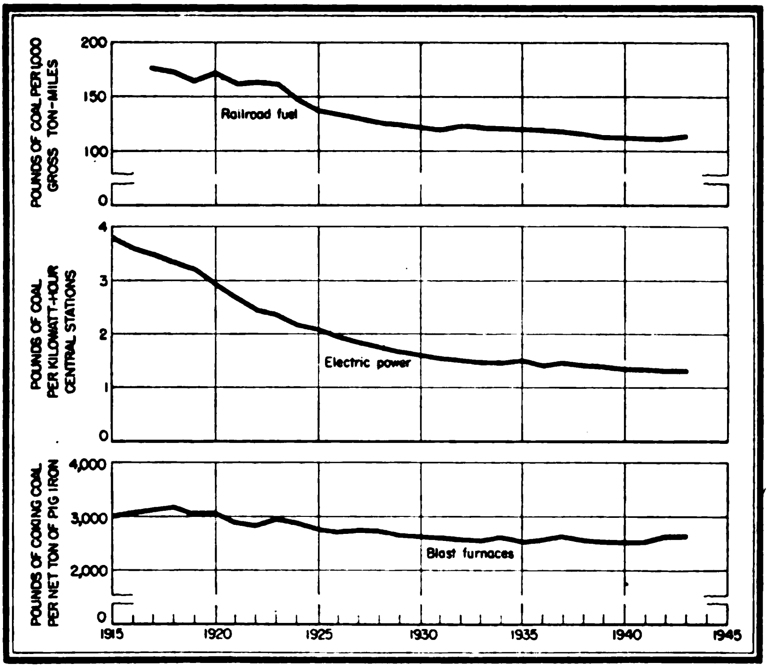

FIGURE 6.—Trends of fuel efficiency in the United States, 1915–43.

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER, 1889–1943

According to preliminary data, the total supply of available energy in the form of coal, oil, natural gas, and water power in 1943 was 33,712 trillion B. t. u.—a 5.4-percent increase over 1942 (see fig. 7). The figures are expressed in British thermal units because some common denominator is necessary for such unlike quantities as tons of coal, barrels of oil, and cubic feet of gas. Table 9 summarizes the equivalent of each of the fuels in trillions of British thermal units. Water power is represented by the equivalent fuel required to perform the same work. The table covers the years since 1933. Details for 1889 to 1932 are given in Minerals Yearbook, 1937, page 807.

In converting water power to its fuel equivalent, two alternative assumptions have been made. The first, as in previous issues of these tables, assumes a *constant* fuel equivalent of 4.02 pounds of coal for each kilowatt-hour of water power produced throughout the entire period from 1889 to 1943. This factor was selected because it represents, in round numbers, the average efficiency of all central stations generating steam-electric power in 1913, the midpoint of the period under review. The usefulness of the *constant* factor lies in showing the rate at which water power is being developed. It permits direct comparison between the relative increase (in kilowatt-hours of water power) and the corresponding increase or decrease (in tons of coal, barrels of oil, or cubic feet of gas produced). On the other hand, the *constant* factor makes no allowance for the fact that coal and other fuels produced today are used more efficiently than formerly.

To throw light on the influence of improving fuel efficiency, a second computation of the energy equivalent of water power has therefore been made. This assumes a *prevailing* fuel equivalent, diminishing year by year, which represents the average performance of all fuel-burning central electric stations for the year in question. This average has declined from about 7.05 pounds of coal per kilowatt-hour in 1899 to 1.31 pounds in 1943. (The *prevailing* factor is thus much above the *constant* factor in 1899 and much below it in 1943.) The *prevailing* fuel equivalent indicates more nearly the quantity of fuel that would have been needed in any one year to generate the same power in a steam-electric station. It should be noted, however, that the ultimate uses to which the water power generated is put, often displace fuel burned much less efficiently than in central stations and that in any instance no other important branch of fuel consumption has made advances in fuel efficiency approaching that of the central stations.

As these tables attempt to determine the total energy from all fuels and from water power, the ideal factor for converting water power into fuel equivalent would be the average efficiency of all forms of fuel consumption in each year. No basis for determining such an all-embracing average exists at present, but enough is known to make certain that it would show much less reduction from 1899 to 1943 than did the central stations. For the present, a just comparison of the changing contributions of water power and of fuel to the national energy supply would lie somewhere between the results shown by the *constant* equivalent and the *prevailing* central-station equivalent in these tables.

As in earlier issues of these tables, the figures for oil and natural gas represent the entire production of crude petroleum and of gas. Most of this production does not come into direct competition with coal. Much of the supply of both oil and gas is used in regions of the country, such as California and portions of the Southwest, where coal is available only at unusually high cost because of heavy transport charges. Nearly half of the natural gas is used in the field for drilling or operating oil and gas wells and pipe lines or for the manufacture of carbon black. More than half the oil is used in the form of gasoline, kerosene, and lubricants, for which purposes coal cannot well compete, except at very much higher levels of oil prices. Even these refined products, however, involve a certain measure of indirect competition with coal, for the energy market of the country is becoming more fluid and competitive, and a demand that cannot be met by one source of supply tends to fall back on the others.

The subject of interfuel competition is exceedingly complex, and an elaborate analysis and the accumulation of data not now available would be required to determine even approximately how much of any one fuel actually has been displaced either by other fuels or by water power. The present tables do not permit determination of such displacement; their purpose is rather to measure the long-time trends in the total demand for energy.

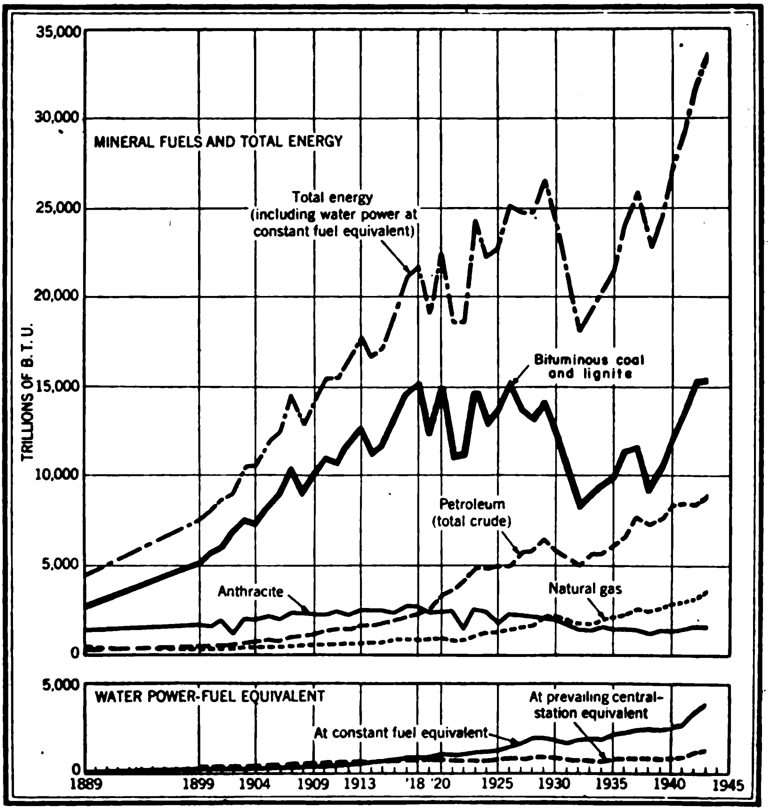

FIGURE 7.—Annual supply of energy from mineral fuels and water power in the United States, 1889–1943.

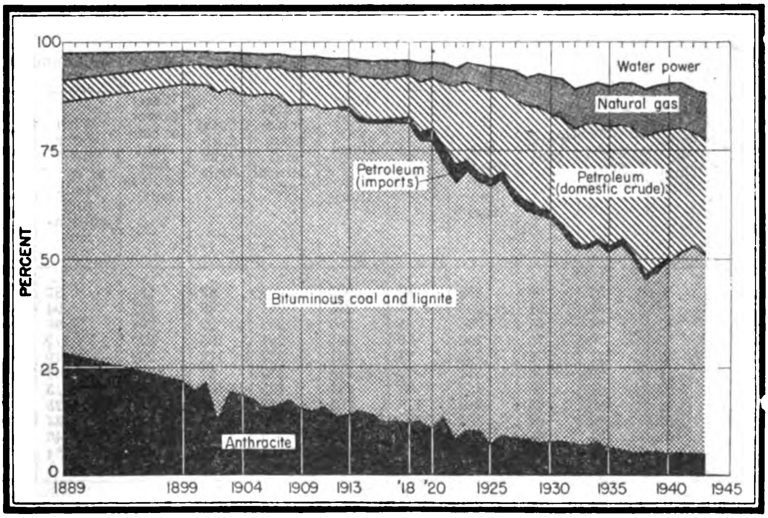

FIGURE 8.—Percentage of total B. t. u. equivalent contributed by the several sources of energy in the United States, counting water power at constant fuel equivalent, 1889–1943. If water power is counted at the prevailing fuel equivalent of central stations in each year, its proportion is 3.2 percent in 1899 and 4.2 percent in 1943, and the proportions of the other sources of energy are affected accordingly.

TABLE 9.—*Annual supply of energy from mineral fuels and water power in the United States, 1933–43,*[1] *in trillions of B. t. u.*[2]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude, including that refined)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (fuel equivalent)		Grand total energy	
				Domestic production	Imports				At constant fuel equivalent[3]	At prevailing central station equivalent[4]	Water power at constant fuel equivalent	Water power at prevailing central station equivalent
1933	1,348	8,741	10,089	5,434	191	1,672	7,297	17,386	1,931	711	19,317	18,097
1934	1,555	9,415	10,970	5,448	213	1,904	7,565	18,535	1,896	698	20,431	19,233
1935	1,419	9,756	11,175	5,980	193	2,060	8,233	19,408	2,207	806	21,615	20,214
1936	1,485	11,504	12,989	6,598	194	2,330	9,122	22,111	2,256	812	24,367	22,923
1937	1,410	11,673	13,083	7,675	165	2,588	10,428	23,511	2,446	871	25,957	24,382
1938	1,255	9,132	10,387	7,286	158	2,468	9,912	20,299	2,466	866	22,765	21,165
1939	1,400	10,345	11,745	7,590	199	2,663	10,452	22,197	2,423	838	24,620	23,035
1940	1,400	12,072	13,472	8,119	256	2,860	11,235	24,707	2,620	880	27,327	25,587
1941[5]	1,533	13,471	15,004	8,413	(6)	3,024	[6] 11,437	[6] 26,441	2,804	934	[6] 29,245	[6] 27,375
1942[5]	1,641	15,267	16,908	8,320	(6)	3,282	[6] 11,602	[6] 28,510	3,485	1,136	[6] 31,995	[6] 29,646
1943[5]	1,641	15,432	17,073	9,019	(6)	3,622	[6] 12,641	[6] 29,714	3,998	1,303	[6] 33,712	[6] 31,017

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 807.

[2] The unit heat values employed are: Anthracite, 13,600 B. t. u. per pound; bituminous coal and lignite, 13,100 B. t. u. per pound; petroleum, 6,000,000 B. t. u. per barrel; natural gas, 1,075 B. t. u. per cubic foot. Water power includes installations owned by manufacturing plants and mines, as well as Government and privately owned public utilities. The fuel equivalent of water power is calculated from the kilowatt-hours of power produced wherever available, as is true of all public-utility plants since 1919. Otherwise, the fuel equivalent is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 percent for manufacturers and mines and of 40 percent for public utilities.

[3] Assuming 4.02 pounds per kilowatt-hour, which is the average of central electric station practice in 1913, the base period used.

[4] Assuming the average central-station practice for each of the years for which data are available, which declined from about 7.05 pounds per kilowatt-hour in 1899 to 1.31 pounds in 1943.

[5] Subject to revision.

[6] Excludes imports of crude petroleum. Figures not available for publication.

TABLE 10.—*Index numbers for relative rate of growth of coal, oil, and water power in the United States, 1933–43*[1]

[The figures are expressed as a percentage of the 1913 rate]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (at constant fuel equivalent)	Grand total	
				Domestic production	Imports					With water power at constant fuel equivalent	With water power at prevailing central station equivalent
1933	50	57	56	252	90	205	229	82	231	87	83
1934	58	62	61	255	94	246	241	88	227	94	89
1935	53	64	63	280	85	266	262	92	264	99	93
1936	55	76	73	309	86	301	291	105	270	112	106
1937	52	77	73	359	73	334	332	112	292	119	112
1938	47	60	58	341	70	318	316	97	295	104	98
1939	52	68	66	355	88	344	333	106	289	113	106
1940	52	80	75	380	113	369	358	118	313	125	118
1941[2]	57	89	84	394	(3)	390	[3] 365	[3] 126	335	[3] 134	[3] 126
1942[2]	61	101	95	390	(3)	423	[3] 370	[3] 136	416	[3] 146	[3] 137
1943[2]	61	102	96	422	(3)	467	[3] 403	[3] 142	478	[3] 154	[3] 143

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 809.

[2] Subject to revision.

[3] Excludes imports of crude petroleum. Figures not available for publication.

TABLE 11.—*Percentage of total B. t. u. equivalent contributed by the several mineral fuels and water power in the United States, 1933–43* [1]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power, fuel equivalent	Grand total, including water power
				Domestic production	Imports					
	Water power counted at constant fuel equivalent of approximately 4 pounds per kilowatt-hour									
1933	7.0	45.2	52.2	28.1	1.0	8.7	37.8	90.0	10.0	100.0
1934	7.6	46.1	53.7	26.7	1.0	9.3	37.0	90.7	9.3	100.0
1935	6.6	45.1	51.7	27.7	.9	9.5	38.1	89.8	10.2	100.0
1936	6.1	47.2	53.3	27.1	.8	9.5	37.4	90.7	9.3	100.0
1937	5.4	45.0	50.4	29.6	.6	10.0	40.2	90.6	9.4	100.0
1938	5.5	40.1	45.6	32.0	.7	10.8	43.5	89.1	10.9	100.0
1939	5.7	42.0	47.7	30.8	.8	10.8	42.4	90.1	9.9	100.0
1940	5.1	44.2	49.3	29.7	.9	10.5	41.1	90.4	9.6	100.0
1941 [2]	5.2	46.1	51.3	28.8	(3)	10.3	39.1	90.4	9.6	100.0
1942 [2]	5.1	47.7	52.8	26.0	(3)	10.3	36.3	89.1	10.9	100.0
1943 [2]	4.8	45.8	50.6	26.8	(3)	10.7	37.5	88.1	11.9	100.0
	Water power counted at prevailing central-station equivalent for year									
1933	7.4	48.4	55.8	30.0	1.1	9.2	40.3	96.1	3.9	100.0
1934	8.1	49.0	57.1	28.3	1.1	9.9	39.3	96.4	3.6	100.0
1935	7.0	48.3	55.3	29.5	1.0	10.2	40.7	96.0	4.0	100.0
1936	6.5	50.2	56.7	28.8	.8	10.2	39.8	96.5	3.5	100.0
1937	5.8	47.8	53.6	31.5	.7	10.6	42.8	96.4	3.6	100.0
1938	5.9	43.2	49.1	34.4	.7	11.7	46.8	95.9	4.1	100.0
1939	6.1	44.9	51.0	32.9	.9	11.6	45.4	96.4	3.6	100.0
1940	5.5	47.2	52.7	31.7	1.0	11.2	43.9	96.6	3.4	100.0
1941 [2]	5.6	49.2	54.8	30.7	(3)	11.1	41.8	96.6	3.4	100.0
1942 [2]	5.5	51.5	57.0	28.1	(3)	11.1	39.2	96.2	3.8	100.0
1943 [2]	5.3	49.7	55.0	29.1	(3)	11.7	40.8	95.8	4.2	100.0

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[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 810.

[2] Subject to revision. Percentages based upon figures in table 9.

[3] Figures not available for publication.

DISTRIBUTION

TABLE 12.—*Trends in distribution of bituminous coal and lignite in the United States, 1937–43*

[For details and sources of data, see Monthly Report on Distribution of Coal Shipments. Tonnage figures shown in thousands of net tons]

	1937		1938		1939		1940		1941		1942		1943 (preliminary)	
	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent
New England receipts:														
Via rail across the Hudson	4,885		4,104		4,626		4,892		6,385		9,894		10,365	
Lake Erie loadings (cargo and fuel):														
By fields of origin:														
From Ohio	3,231	7.1	2,390	6.8	2,356	5.7	2,646	5.5	3,947	7.7	4,171	8.5	4,682	9.9
From Pittsburgh and other Pennsylvania	11,763	26.0	8,019	22.8	9,259	22.5	11,578	24.1	11,612	22.6	9,305	18.8	8,409	17.7
From Moundsville, Fairmont, and Cumberland-Piedmont	2,319	5.1	1,389	4.0	1,963	4.8	2,357	4.9	2,963	5.8	2,778	5.6	2,763	5.8
From southern West Virginia:														
High volatile	10,975	24.3	8,329	23.7	10,883	26.5	12,025	25.0	14,277	27.8	14,746	29.8	14,256	30.1
Low volatile	8,428	18.6	7,612	21.7	8,665	21.1	10,372	21.6	9,010	17.5	9,160	18.5	8,653	18.2
From east Kentucky, Tennessee, and Virginia	8,530	18.9	7,392	21.0	7,998	19.4	9,133	18.9	9,585	18.6	9,295	18.8	8,692	18.3
Total	45,246	100.0	35,131	100.0	41,124	100.0	48,111	100.0	51,394	100.0	49,455	100.0	47,455	100.0
By destinations (cargo only):														
To American points	35,123	80.6	27,656	80.9	33,188	83.3	37,804	81.2	38,823	78.1	36,267	75.9	34,146	74.1
To Canadian points	8,479	19.4	6,510	19.1	6,672	16.7	8,778	18.8	10,886	21.9	11,544	24.1	11,939	25.9
Total	43,602	100.0	34,166	100.0	39,860	100.0	46,582	100.0	49,709	100.0	47,811	100.0	46,085	100.0
Across Lake Michigan car ferry	650		588		592		612		627		740		769	
West-bound rail to Mississippi Valley (revenue all-rail shipments, excluding railroad fuel, Lake coal, and movements to Kentucky points):														
From Ohio fields	11,861	9.6	8,042	8.7	9,052	8.4	9,807	8.0	10,846	7.9	11,719	7.4	12,679	7.6
From Pennsylvania fields	15,091	12.1	9,620	10.4	12,200	11.4	15,195	12.4	16,663	12.1	18,141	11.5	18,189	11.0
From northern West Virginia and Cumberland-Piedmont	3,521	2.8	2,615	2.8	3,227	3.0	3,467	2.8	4,728	3.4	5,201	3.3	6,268	3.8
From southern West Virginia:														
High volatile	17,293	13.9	13,668	14.8	15,099	14.0	16,943	13.8	18,275	13.3	21,500	13.6	22,739	13.7
Low volatile	19,575	15.8	13,335	14.5	15,946	14.8	19,536	15.9	22,773	16.6	25,005	15.9	24,477	14.8

From east Kentucky, Tennessee, and Virginia	17,953	14.5	14,120	15.3	15,749	14.7	18,340	14.9	18,980	13.8	22,770	14.4	[illegible]	[illegible]
Total from Appalachian fields	85,294	68.6	61,400	66.5	71,273	66.3	83,288	67.8	92,265	67.1	104,336	66.1	107,362	64.8
From Illinois	26,625	21.4	20,719	22.5	24,879	23.1	27,618	22.5	30,100	21.9	36,992	23.4	42,326	25.6
From Indiana	10,594	8.5	8,501	9.2	9,455	8.8	10,223	8.3	12,499	9.0	14,031	8.9	13,680	8.3
From west Kentucky	1,859	1.5	1,661	1.8	1,917	1.8	1,758	1.4	2,735	2.0	2,556	1.6	2,224	1.3
Total from Middle West fields	39,078	31.4	30,881	33.5	36,251	33.7	39,599	32.2	45,334	32.9	53,579	33.9	58,230	35.2
Grand total	124,372	100.0	92,281	100.0	107,524	100.0	122,887	100.0	137,599	100.0	157,915	100.0	165,592	100.0
Total shipments from other groups (all shipments, including, in this case, nonrevenue railroad fuel): [1]														
From Michigan fields	181	([2] [3])	166	([2] [3])	122	([2] [3])	103	([2] [3])	120	([2] [3])	71	([2] [3])	56	([2] [3])
From upper Lake commercial docks, all deliveries	13,518	[2] 3.1	10,845	[2] 3.1	11,111	[2] 2.8	12,054	[2] 2.6	12,473	[2] 2.4	14,036	[2] 2.4	15,811	[2] 2.8
From Iowa, Missouri, Kansas	7,202	[2] 1.6	6,528	[2] 1.9	6,088	[2] 1.5	6,411	[2] 1.4	6,731	[2] 1.3	7,361	[2] 1.3	8,043	[2] 1.4
From Arkansas, Oklahoma, Texas	3,739	[2] .8	3,126	[2] .9	2,946	[2] .7	3,394	[2] .7	3,411	[2] .7	4,348	[2] .7	4,244	[2] .7
From Far West fields	21,867	[2] 4.9	17,612	[2] 5.1	18,442	[2] 4.7	19,658	[2] 4.3	22,009	[2] 4.3	27,154	[2] 4.7	29,368	[2] 5.0
From Alabama field	11,771	[2] 2.7	10,382	[2] 3.0	11,233	[2] 2.8	14,288	[2] 3.1	14,310	[2] 2.8	17,525	[2] 3.0	16,408	[2] 2.8

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[1] Excluding commercial sales by truck and wagon, except from upper Lake docks.

[2] Percent of total national shipments from all mines, all destinations.

[3] Less than 0.1 percent.

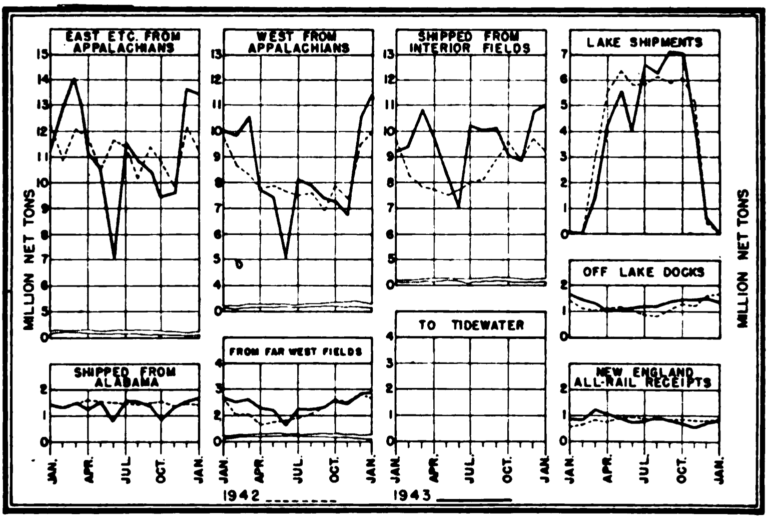

FIGURE 9.—Monthly movement of bituminous coal and lignite in the United States in the major channels of distribution, 1942–43.

STOCKS HELD BY CONSUMERS

TABLE 13.—*Stocks of bituminous coal and lignite in hands of commercial consumers and in retail dealers' yards in the United States, 1942–43*

Date	Total stock (net tons)	Days' supply at current rate of consumption on date of stock taking								
		By-product-coke plants	Steel plants	Other industrials	Coal gas plants	Electric utilities	Retail yards	Railroads	Cement mills	Total
1942										
Jan. 1	62,737,000	38	30	50	76	67	27	34	37	40
Feb. 1	58,681,000	34	30	45	72	66	17	31	36	34
Mar. 1	56,885,000	33	30	42	66	73	15	30	37	34
Apr. 1	57,221,000	33	33	48	59	86	17	32	42	38
May 1	61,836,000	35	37	54	63	94	21	35	43	43
June 1	67,418,000	38	42	69	71	96	26	38	42	49
July 1	73,271,000	41	45	78	80	98	33	41	46	54
Aug. 1	77,583,000	41	48	87	96	94	48	44	49	60
Sept. 1	82,686,000	42	50	94	90	99	53	45	50	63
Oct. 1	87,311,000	44	48	92	89	105	42	43	48	61
Nov. 1	89,937,000	45	46	85	86	110	44	41	47	61
Dec. 1	90,874,000	46	42	80	89	111	45	39	47	59
Dec. 31	85,889,000	44	34	69	88	101	28	35	48	51
1943										
Jan. 1	85,889,000	44	34	69	88	101	28	35	48	51
Feb. 1	79,379,000	40	32	64	82	100	21	31	46	46
Mar. 1	76,626,000	39	29	60	76	99	18	30	42	44
Apr. 1	77,292,000	40	33	63	75	100	18	32	46	45
May 1	78,667,000	39	37	66	81	108	21	37	50	49
June 1	79,525,000	37	39	78	84	113	28	39	47	54
July 1	74,075,000	30	36	81	84	94	27	36	42	52
Aug. 1	75,570,000	28	33	84	85	89	28	38	40	52
Sept. 1	75,276,000	27	34	85	91	85	22	40	43	49
Oct. 1	72,866,000	26	33	78	92	81	15	39	47	45
Nov. 1	68,791,000	27	29	66	83	75	15	35	48	42
Dec. 1	60,079,000	24	22	52	65	69	16	28	43	36
Dec. 31	56,686,000	25	22	43	60	61	12	25	42	30

POST-WAR OUTLOOK

The post-war outlook for soft coal revolves around the general level of industrial activity and the extent of competition offered by other fuels. The consumption of soft coal follows very closely the trend of industry, since only a small fraction of the total is used for domestic space-heating. The accumulated demand for many products, particularly for automobiles, machinery, building materials, and household appliances, will doubtless stimulate industry for several years after the close of the war. Barring heavy inroads by competitive fuels, coal should participate in this anticipated activity.

Soft coal is in a better competitive position today than for many years. The shortage of fuel oil and anthracite has enabled soft coal to regain some of its lost markets. The shortage of pipe has retarded the expansion of natural-gas lines. Many consumers who have installed coal-burning equipment during the war will be hesitant to convert to oil or gas, since the life expectancy of the reserves of these fuels is somewhat doubtful. The present program for the development of liquid fuels from coal even indicates that in future coal may be replacing oil.

FINAL BITUMINOUS-COAL AND LIGNITE STATISTICS FOR 1942

Tables 14 to 61 give the final detailed statistics of bituminous-coal and lignite mine operations in 1942. The subjects covered include

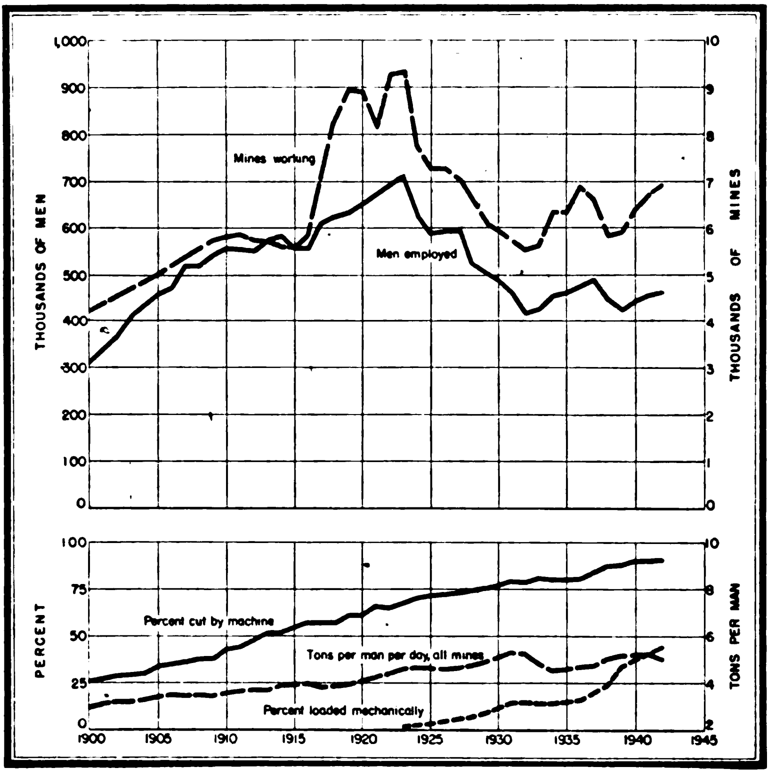

FIGURE 10.—Trends of employment, mechanization, and output per man at bituminous-coal and lignite mines in the United States, 1900–43.

production, number and size of mines, employment, value, mechanization, and world production.

In accordance with the practice followed by the Bureau of Mines in previous years, the statistics in this report relate to mines having an output of 1,000 tons a year or more and do not attempt to include many small mines producing less than 1,000 tons a year that sell their output by wagon or truck.

These statistics include, for convenience and historical comparison, the small output of anthracite and semianthracite produced outside Pennsylvania and the production of lignite.

SALIENT TRENDS

TABLE 14.—*Salient trends in bituminous-coal and lignite-mining industry in the United States, 1935–42*

	1935	1936	1937	1938	1939	1940	1941	1942
Production:								
Loaded at mine for shipment by rail……net tons..	319,741,376	370,762,901	[1] 399,237,575	295,336,027	331,189,620	380,387,674	425,184,319	482,814,042
Loaded at mine for shipment by water……do....	18,327,282	24,867,683	([1])	16,902,969	22,229,364	29,493,058	30,240,489	34,018,025
Shipped by truck or wagon……do....	21,960,252	27,929,298	[2] 37,762,612	25,592,058	29,533,824	35,540,476	40,055,638	45,154,432
Taken by locomotive tenders at tipple……do....	([3])	([3])	([2])	606,857	826,556	939,058	1,099,582	920,213
Shipped by conveyor or tram to point of consumption..do....	([3])	([3])	([2])	4,221,671	4,317,465	5,887,994	6,067,697	7,121,116
Used by mine employees……do....	[3] 7,773,619	[3] 9,571,997	([2])	2,032,289	1,901,408	2,035,201	1,872,026	2,180,077
Used at mines for power and heat……do....	3,102,691	3,227,447	3,052,095	2,493,017	2,565,276	2,442,989	2,488,950	2,708,312
Made into beehive coke at mines……do....	1,467,902	2,728,577	4,884,054	1,359,876	2,089,475	4,045,050	7,140,544	7,776,720
Total production……do....	372,373,122	439,087,903	[4] 445,531,449	348,544,764	[5] 394,855,325	460,771,500	514,149,245	582,692,937
Number of active mines of commercial size:								
Class 1 (200,000 tons or more)……number..	561	660	661	526	577	636	730	811
Class 2 (100,000 to 200,000 tons)……do....	479	452	469	402	404	432	437	484
Class 3 (50,000 to 100,000 tons)……do....	503	460	448	415	387	371	402	445
Class 4 (10,000 to 50,000 tons)……do....	1,056	1,085	1,117	1,042	1,065	1,157	1,305	1,492
Class 5 (1,000 to 10,000 tons)……do....	3,716	4,218	3,853	3,392	3,387	3,728	3,948	3,740
Total number over 1,000 tons……do....	6,315	6,875	6,548	5,777	5,820	6,324	6,822	6,972
Average number of men employed at mines active:								
Underground……men..	389,942	399,367	([6])	370,004	353,476	365,013	376,765	374,654
Surface:								
In strip pits……do....	8,533	8,043	([6])	7,877	8,791	8,983	10,861	12,893
All others……do....	63,928	69,794	([6])	63,452	59,521	65,079	69,355	74,444
Total……do....	462,403	477,204	491,864	441,333	421,788	439,075	456,981	461,991
Average number of days mines operated……days..	179	199	193	162	178	202	216	246
Capacity of active mines with existing labor force:								
Per year of 308 days……net tons..	640,000,000	680,000,000	710,000,000	663,000,000	683,000,000	703,000,000	733,000,000	730,000,000
Per year of 280 days……do....	582,000,000	618,000,000	646,000,000	602,000,000	621,000,000	639,000,000	666,000,000	663,000,000
Per year of 261 days……do....	543,000,000	576,000,000	601,000,000	562,000,000	579,000,000	595,000,000	621,000,000	618,000,000
Output per man per day……do....	4.50	4.62	4.69	4.89	5.25	5.19	5.20	5.12
Output per man per year……do....	805	920	906	790	936	1,049	1,125	1,261
Underground output cut by machine……do....	293,664,208	348,332,330	([6])	278,315,365	313,969,394	369,227,277	408,510,296	462,344,719
Percent of underground output cut by machine……percent..	84.2	84.8	([6])	87.5	87.9	88.4	89.0	89.7
Underground output mechanically loaded……net tons..	47,177,224	66,976,872	83,500,000	85,092,836	110,711,970	147,870,252	186,667,250	232,902,920
Percent of underground output mechanically loaded..percent..	13.5	16.3	20.2	26.7	31.0	35.4	40.7	45.2

See footnotes at end of table.

TABLE 14.—*Salient trends in bituminous-coal and lignite-mining industry in the United States, 1935–42*—Continued

	1935	1936	1937	1938	1939	1940	1941	1942
Quantity mined by stripping.....net tons..	23,647,292	28,125,857	31,750,853	30,406,855	37,722,583	43,167,336	55,071,609	67,202,663
Percent mined by stripping.....percent..	6.4	6.4	7.1	8.7	9.6	9.4	10.7	11.5
Quantity cleaned by wet or pneumatic processes [7].....net tons..	45,361,021	61,094,976	65,000,000	63,454,588	79,429,426	102,269,753	117,539,522	142,187,346
Percent cleaned by wet or pneumatic processes [7].....percent..	12.2	13.9	14.6	18.2	20.1	22.2	22.9	24.4

[1] In 1937, coal loaded at mine for shipment by water is included with "loaded at mine for shipment by rail."

[2] Coal "taken by locomotive tenders at tipple," "shipped by conveyor or tram to point of consumption," and "used by mine employees" included with "shipped by truck or wagon."

[3] In 1935 and 1936 data were not collected in such form as to permit a separation of coal "taken by locomotive tenders at tipple," "shipped by conveyor or tram to point of consumption," and "used by mine employees." They are all included here under "used by mine employees."

[4] The total production differs from the sum of the items shown by the amount of the changes in inventory and the tonnage not accounted for in the distribution analysis. This tonnage amounted to 595,113 net tons.

[5] Includes 202,337 tons of coal reported as net changes in stocks at mines Jan. 1, 1939, to Jan. 1, 1940.

[6] Data not available.

[7] Includes central washeries operated by consumers.

TABLE 15.—*Growth of bituminous-coal- and lignite-mining industry in the United States, 1890–1942*

Year	Production	Value [1]	Value per ton [1]	Men employed	Number of mines	Calculated capacity (millions of net tons)		
						At 308 days	At 280 days	At 261 days
1890	111, 302, 322	$110, 420, 801	$0. 99	192, 204	(2)	152	137	129
1891	117, 901, 238	117, 188, 400	. 99	205, 803	(2)	163	148	138
1892	126, 856, 567	125, 124, 381	. 99	212, 893	(2)	178	162	151
1893	128, 385, 231	122, 751, 618	. 96	230, 365	(2)	194	174	164
1894	118, 820, 405	107, 653, 501	. 91	244, 603	(2)	214	196	181
1895	135, 118, 193	115, 779, 771	. 86	239, 962	2, 555	215	196	182
1896	137, 640, 276	114, 891, 515	. 83	244, 171	2, 599	221	202	187
1897	147, 617, 519	119, 595, 224	. 81	247, 817	2, 454	232	213	197
1898	166, 593, 623	132, 608, 713	. 80	255, 717	2, 862	243	221	206
1899	193, 323, 187	167, 952, 104	. 87	271, 027	3, 245	254	230	216
1900	212, 316, 112	220, 930, 313	1. 04	304, 375	(2)	279	255	237
1901	225, 828, 149	236, 422, 049	1. 05	340, 235	(2)	309	281	262
1902	260, 216, 844	290, 858, 483	1. 12	370, 056	(2)	348	316	295
1903	282, 749, 348	351, 687, 933	1. 24	415, 777	(2)	387	350	328
1904	278, 659, 689	305, 397, 001	1. 10	437, 832	4, 650	425	386	360
1905	315, 062, 785	334, 658, 294	1. 06	460, 629	5, 060	460	417	390
1906	342, 874, 867	381, 162, 115	1. 11	478, 425	4, 430	496	451	420
1907	394, 759, 112	451, 214, 842	1. 14	513, 258	4, 550	520	473	440
1908	332, 573, 944	374, 135, 268	1. 12	516, 264	4, 730	531	482	450
1909	379, 744, 257	405, 486, 777	1. 07	543, 152	5, 775	560	510	474
1910	417, 111, 142	469, 281, 719	1. 12	555, 533	5, 818	592	538	502
1911	405, 907, 059	451, 375, 819	1. 11	549, 775	5, 887	593	538	502
1912	450, 104, 982	517, 983, 445	1. 15	548, 632	5, 747	622	566	527
1913	478, 435, 297	565, 234, 952	1. 18	571, 882	5, 776	635	577	538
1914	422, 703, 970	493, 309, 244	1. 17	583, 506	5, 592	668	608	566
1915	442, 624, 426	502, 037, 688	1. 13	557, 456	5, 502	672	610	569
1916	502, 519, 682	665, 116, 077	1. 32	561, 102	5, 726	673	613	570
1917	551, 790, 563	1, 249, 272, 837	2. 26	603, 143	6, 939	699	636	593
1918	579, 385, 820	1, 491, 809, 940	2. 58	615, 305	8, 319	717	650	607
1919	465, 860, 058	1, 160, 616, 013	2. 49	621, 998	8, 994	736	669	624
1920	568, 666, 683	2, 129, 933, 000	3. 75	639, 547	8, 921	796	725	675
1921	415, 921, 950	1, 199, 983, 600	2. 89	663, 754	8, 038	860	781	729
1922	422, 268, 099	1, 274, 820, 000	3. 02	687, 958	9, 299	916	832	776
1923	564, 564, 662	1, 514, 621, 000	2. 68	704, 793	9, 331	970	885	823
1924	483, 686, 538	1, 062, 626, 000	2. 20	619, 604	7, 586	871	792	738
1925	520, 052, 741	1, 060, 402, 000	2. 04	588, 493	7, 144	822	748	696
1926	573, 366, 985	1, 183, 412, 000	2. 06	593, 647	7, 177	821	747	696
1927	517, 763, 352	1, 029, 657, 000	1. 99	593, 918	7, 011	835	759	708
1928	500, 744, 970	933, 774, 000	1. 86	522, 150	6, 450	760	691	644
1929	534, 988, 593	952, 781, 000	1. 78	502, 993	6, 057	752	679	638
1930	467, 526, 299	795, 483, 000	1. 70	493, 202	5, 891	770	700	653
1931	382, 089, 396	588, 895, 000	1. 54	450, 213	5, 642	736	669	623
1932	309, 709, 872	406, 677, 000	1. 31	406, 380	5, 427	653	594	554
1933	333, 630, 533	445, 788, 000	1. 34	418, 703	5, 555	615	559	521
1934	359, 368, 022	628, 383, 000	1. 75	458, 011	6, 258	622	565	527
1935	372, 373, 122	658, 063, 000	1. 77	462, 403	6, 315	640	582	543
1936	439, 087, 903	770, 955, 000	1. 76	477, 204	6, 875	680	618	576
1937	445, 531, 449	864, 042, 000	1. 94	491, 864	6, 548	710	646	601
1938	348, 544, 764	678, 653, 000	1. 95	441, 333	5, 777	663	602	562
1939	394, 855, 325	728, 348, 366	1. 84	421, 788	5, 820	683	621	579
1940	460, 771, 500	879, 327, 227	1. 91	439, 075	6, 324	703	639	595
1941	514, 149, 245	1, 125, 362, 836	2. 19	456, 981	6, 822	733	666	621
1942	582, 692, 937	1, 373, 990, 608	2. 36	461, 991	6, 972	730	663	618

[1] Figures on value and value per ton for 1890 to 1936, inclusive, and 1939 exclude selling expense. Figures for other years include selling expense.

[2] Data not available.

TABLE 15.—*Growth of the bituminous-coal- and lignite-mining industry in the United States, 1890–1942*—Continued

Year	Average number of days worked	Average number of days lost on account of strikes		Net tons per man		Percent of underground production		Percent of total production	
		Per man employed	Per man on strike	Per day	Per year	Cut by machines [1]	Mechanically loaded	Mechanically cleaned [2]	Mined by stripping
1890	226	(3)	(3)	2.56	579	(3)	(3)	(3)	(3)
1891	223	(3)	(3)	2.57	573	5.3	(3)	(3)	(3)
1892	219	(3)	(3)	2.72	596	(3)	(3)	(3)	(3)
1893	204	(3)	(3)	2.73	557	(3)	(3)	(3)	(3)
1894	171	(3)	(3)	2.84	486	(3)	(3)	(3)	(3)
1895	194	(3)	(3)	2.90	563	(3)	(3)	(3)	(3)
1896	192	(3)	(3)	2.94	564	11.9	(3)	(3)	(3)
1897	196	(3)	(3)	3.04	596	15.3	(3)	(3)	(3)
1898	211	(3)	(3)	3.09	651	19.5	(3)	(3)	(3)
1899	234	8	46	3.05	713	22.7	(3)	(3)	(3)
1900	234	5	43	2.98	697	24.9	(3)	(3)	(3)
1901	225	2	35	2.94	664	25.6	(3)	(3)	(3)
1902	230	7	44	3.06	703	26.8	(3)	(3)	(3)
1903	225	3	28	3.02	680	27.6	(3)	(3)	(3)
1904	202	8	44	3.15	637	28.2	(3)	(3)	(3)
1905	211	2	23	3.24	684	32.8	(3)	(3)	(3)
1906	213	28	63	3.36	717	34.7	(3)	2.7	(3)
1907	234	1	14	3.29	769	35.1	(3)	2.9	(3)
1908	193	11	38	3.34	644	37.0	(3)	3.6	(3)
1909	209	1	29	3.34	699	37.5	(3)	3.8	(3)
1910	217	35	89	3.46	751	41.7	(3)	3.8	(3)
1911	211	2	27	3.50	738	43.9	(3)	(3)	(3)
1912	223	10	35	3.68	820	46.8	(3)	3.9	(3)
1913	232	4	36	3.61	837	50.7	(3)	4.6	(3)
1914	195	19	80	3.71	724	51.8	(3)	4.8	0.3
1915	203	4	61	3.91	794	55.3	(3)	4.7	.6
1916	230	4	26	3.90	896	56.9	(3)	4.6	.8
1917	243	4	17	3.77	915	56.1	(3)	4.6	1.0
1918	249	1	7	3.78	942	56.7	(3)	3.8	1.4
1919	195	25	37	3.84	749	60.0	(3)	3.6	1.2
1920	220	6	22	4.00	881	60.7	(3)	3.3	1.5
1921	149	3	23	4.20	627	66.4	(3)	3.4	1.2
1922	142	78	117	4.28	609	64.8	(3)	(3)	2.4
1923	179	2	20	4.47	801	68.3	0.3	3.8	2.1
1924	171	7	73	4.56	781	71.5	.7	(3)	2.8
1925	195	2	30	4.52	884	72.9	1.2	(3)	3.2
1926	215	1	24	4.50	966	73.8	1.8	(3)	3.0
1927	191	45	153	4.55	872	74.9	(3)	5.3	3.6
1928	203	8.	83	4.73	959	76.9	4.5	5.7	4.0
1929	219	(4)	11	4.85	1,064	78.4	7.4	6.9	3.8
1930	187	2	43	5.06	948	81.0	10.5	8.3	4.3
1931	160	3	35	5.30	849	83.2	13.1	9.5	5.0
1932	146	19	120	5.22	762	84.1	12.3	9.8	6.3
1933	167	9	30	4.78	797	84.7	12.0	10.4	5.5
1934	178	3	15	4.40	785	84.1	12.2	11.1	5.8
1935	179	(3)	(3)	4.50	805	84.2	13.5	12.2	6.4
1936	199	2	21	4.62	920	84.8	16.3	13.9	6.4
1937	193	(3)	(3)	4.69	906	(3)	20.2	14.6	7.1
1938	162	1	13	4.89	790	87.5	26.7	18.2	8.7
1939	178	25	36	5.25	936	87.9	31.0	20.1	9.6
1940	202	1	8	5.19	1,049	88.4	35.4	22.2	9.4
1941	216	20	27	5.20	1,125	89.0	40.7	22.9	10.7
1942	246	1	7	5.12	1,261	89.7	45.2	24.4	11.5

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[1] Percentages for 1890 to 1913, inclusive, are of total production, as a separation of strip-mine and underground production is not available for these years.

[2] For the years 1906 to 1926, inclusive, these percentages are exclusive of coal cleaned at central washeries operated by consumers; after 1926, when data became available on the tonnage cleaned by consumer-operated plants, the percentages include the total tons cleaned at the mines and at consumer-operated washeries.

[3] Data not available.

[4] One-half day or less.

Table 16.—*Coal produced in the United States, by States, 1932–42, with production of maximum year and cumulative production from the earliest record to the end of 1942, in thousands of net tons*

State	Maximum production		Production by years											Total production from earliest record to end of 1942
	Year	Quantity	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	
Alabama	1926	21,001	7,857	8,760	9,142	8,505	12,229	12,440	11,062	12,047	15,324	15,464	19,301	701,164
Arkansas	1907	2,670	1,033	883	857	1,133	1,623	1,511	1,197	1,152	1,454	1,574	1,985	79,706
Colorado	1917	12,483	5,599	5,230	5,211	5,911	6,812	7,187	5,663	5,923	6,589	6,949	8,086	424,469
Georgia	1903	416	27	41	33	(1)	(1)	(1)	(1)	(1)	(1)	(1)	31	(1)
Illinois	1918	89,291	33,475	37,413	41,272	44,525	50,927	51,602	41,912	46,783	50,610	54,703	65,071	2,664,970
Indiana	1918	30,679	13,324	13,761	14,794	15,754	17,822	17,765	14,759	16,943	18,869	22,484	25,388	819,533
Iowa	1917	8,966	3,862	3,195	3,367	3,650	3,961	3,637	3,103	2,948	3,231	2,939	2,948	323,908
Kansas	1918	7,562	1,953	2,218	2,508	2,686	2,944	2,893	2,654	2,675	3,579	4,008	4,230	246,210
Kentucky	1927	69,124	35,300	36,100	38,525	40,761	47,522	47,086	38,545	42,557	49,141	53,710	62,231	1,456,153
Maryland	1907	5,533	1,429	1,531	1,627	1,678	1,704	1,549	1,281	1,443	1,503	1,701	2,001	247,876
Michigan	1907	2,036	446	407	622	628	626	562	494	457	410	311	231	45,819
Missouri	1917	5,671	4,070	3,432	3,352	3,646	3,985	4,091	3,436	3,273	3,097	3,145	3,520	228,757
Montana (bituminous and lignite)	1918	4,533	2,125	2,152	2,566	2,759	2,988	2,965	2,732	2,804	2,867	3,254	3,829	130,554
New Mexico	1918	4,023	1,263	1,226	1,259	1,389	1,597	1,715	1,239	1,230	1,111	1,251	1,669	111,270
North Carolina	1922	79	2	2	3	(1)	(1)							(1)
North Dakota (lignite)	1942	2,537	1,740	1,782	1,754	1,956	2,215	2,251	2,050	2,072	2,218	2,309	2,537	49,009
Ohio	1920	45,878	13,909	19,589	20,691	21,153	24,110	25,178	18,591	20,289	22,772	29,319	32,764	1,459,282
Oklahoma	1920	4,849	1,255	1,238	1,208	1,229	1,540	1,600	1,245	1,188	1,646	1,771	2,387	137,267
Pennsylvania (bituminous)	1918	178,551	74,776	79,296	89,826	91,405	109,887	111,002	77,705	92,584	116,603	130,240	144,073	6,449,391
Tennessee	1942	8,158	3,538	3,775	4,136	4,138	5,108	5,213	4,472	5,185	6,008	7,045	8,158	281,065
Texas (bituminous and lignite)	1913	2,429	637	822	759	758	843	910	879	826	621	353	304	60,346
Utah	1920	6,005	2,852	2,675	2,406	2,947	3,247	3,810	2,947	3,285	3,576	4,077	5,517	151,006
Virginia	1942	20,136	7,692	8,179	9,377	9,667	11,662	13,795	12,283	13,531	15,348	18,441	20,136	428,813
Washington	1918	4,082	1,591	1,394	1,383	1,559	1,812	2,002	1,567	1,690	1,650	1,841	1,953	133,812
West Virginia	1942	155,882	85,609	94,344	98,134	99,179	117,926	118,646	93,288	108,362	126,438	140,250	155,882	3,874,551
Wyoming	1920	9,630	4,171	4,013	4,368	5,177	5,781	5,918	5,204	5,373	5,808	6,646	8,133	306,820
Other States			175	173	188	180	217	203	237	235	299	364	328	62,952
Total bituminous and lignite	1942	582,693	309,710	333,631	359,368	372,373	439,088	445,531	348,545	394,855	460,772	514,149	582,693	20,874,703
Pennsylvania anthracite	1917	99,612	49,855	49,541	57,168	52,159	54,580	51,856	46,099	51,487	51,485	56,368	60,328	4,502,125
Grand total			359,565	383,172	416,536	424,532	493,668	497,387	394,644	446,342	512,257	570,517	643,021	25,376,828

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[1] Included under "Other States."

SUMMARY BY STATES AND DISTRICTS

TABLE 17.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States, in 1942*

[Exclusive of mines producing less than 1,000 tons]

State	Disposition of coal produced (net tons)								Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded at mine directly into railroad cars or river barges	Hauled by truck to railroad siding for shipment by rail and to waterway for shipment by water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Taken by locomotive tenders at tipple	Shipped by conveyor or tram to point of consumption	Used by mine employees	Used at mines for power and heat and made into beehive coke at mines [2]	Total quantity		Underground	Surface		Total			
											In strip pits	All others				
Alabama	16,934,945	[1] 561,395	1,266,122	68,115	268.707	79,877	[2] 122,093	19,301.254	$2.87	22,361	195	3,597	26,153	262	6.847.319	2.82
Alaska	239,556	3,169	8.553				9,615	260.893	6.22	183		65	248	209	74,064	3.52
Arizona			10,991			382		11,373	2.64	26		3	29	191	5.534	2.06
Arkansas	1,568,755	299.052	102,400			7,135	8.051	1.985.393	3.80	2,727	103	563	3,393	196	664.377	2.99
Colorado	5,816,172	202,492	1,682,647	8,440	57,154	48,389	[2] 270,386	8,085,680	2.86	6,272	9	1,424	7,705	243	1,874.136	4.31
Georgia	28,814		215			804	1,080	30,913	3.28	71		41	112	252	28.224	1.10
Illinois	55,637,795	[1] 366,013	7.732.174	40,285	191.509	223.757	879,286	65.070.819	1.91	24,296	1,774	7,313	33,383	226	7,550,499	8.62
Indiana	21,558,739	614.516	2,622,933	9,680	397.487	36.016	148,680	25,388.051	1.78	5,363	2,033	3,004	10,400	228	2,371,647	10.70
Iowa	957,563	422,618	1,520,369			31,297	15.875	2.947,722	2.85	3,466	294	581	4,341	189	820,150	3.59
Kansas	3,827,960	8,644	374,335			8,440	10.479	4,229,858	2.19	1,250	610	603	2,463	239	589,498	7.18
Kentucky	56,824,576	[1] 1,840.042	2.734.233	71.021	345.545	251.594	[2] 163.755	62.230,766	2.36	50,305	215	8,892	59.412	235	13,957,963	4.46
Maryland	1,535.022	97.374	353,882			9,839	4,817	2,000.934	2.60	2,093	16	288	2,397	245	587,351	3.41
Michigan	69,930		146,472			5,393	9.353	231.148	4.42	329		51	380	242	91,857	2.52
Missouri	1,988,400	155,347	1,334,279			16.146	25,705	3.519.877	2.38	2,286	635	590	3,511	216	757,600	4.65
Montana:																
Bituminous	3,596,620	3,081	164.569	635	10	10.769	3,860	3,779,544	1.62	884	72	361	1,317	242	319,072	11.85
Lignite	(4)	(4)	(4)			(5)	[5] 148	49,138	1.89	51	14	17	82	143	11,722	4.19
Total, Montana	3.596,620	3,081	164,569	635	10	10,769	4,008	3,828,682	1.63	935	86	378	1,399	236	330,794	11.57
New Mexico	1,476,451	31,434	112,591	2,257		10.184	35,742	1.668,659	3.15	1,546		477	2,023	259	524,403	3.18
North Dakota (lignite)	1.863,462	18,645	525,118		[6] 94,974	(5)	34.817	2,537,016	1.40	491	386	307	1,184	205	242,581	10.46
Ohio	23,443,468	[1] 2,416,288	6,713.960	40.746	36,209	40,557	73,240	32,764,468	2.10	16,498	2,169	4,278	22,945	240	5,507,320	5.95

Oklahoma	1,912,088	273,132	185,125			2,052	14,795	2,387,192	2.84	1,618	267	469	2,354	217	510,457	4.68
Oregon			2,120			17		2,137	4.44	7		1	8	173	1,384	1.54
Pennsylvania	112,192,659	[1] 6,998,732	13,249,951	235,177	3,965.516	420,748	[2] 7,010,406	144,073,189	2.48	101,092	3,209	16,090	120,391	254	30,600,661	4.71
South Dakota (lignite)	([4] [5])	[4] [5] 28,995	[4] 73,410			105	18	53,538	1.94	11	33	7	51	198	10,118	5.29
Tennessee	7,161 586	[1] 300,937	567,144	40,486		57.459	[2] 30,625	8,158,237	2.54	8,192		1,426	9,618	246	2,365,897	3.45
Texas:																
Bituminous	9,053		4,057			100		13,210	4.17	44		10	54	77	4,164	3.17
Lignite	286,110		1,597				3,262	290,969	.85	130	32	11	173	194	33,483	8.69
Total, Texas	295,163		5,654			100	3,262	304,179	.99	174	32	21	227	166	37,647	8.08
Utah	4.966,236	18.858	442.223	1,055		32,446	[2] 56,031	5,516,849	2.59	2,292		874	3,166	252	798,767	6.91
Virginia	18,856.344	173,613	396,113			123.855	[2] 586,254	20,136,179	2.59	17,013		2,403	19,416	245	4.765,150	4.23
Washington	1,234,720	100.116	547.045	38,619		16,273	16,436	1,953,209	3.87	1,689	5	460	2,154	274	590,508	3.31
West Virginia	146,345.148	[1] 3.767.452	2,078.454	362.207	1,764,005	710.505	[2] 853,726	155,881.497	2.42	98.431	768	19,323	118,522	253	30,034,180	5.19
Wyoming	7,656,979	140,971	201,350	1,490		35.938	96.497	8,133,225	2.20	3,637	54	915	4,606	258	1,187.196	6.85
Total	497,989,151	[1] 18,842,916	45,154,432	920,213	7,121,116	2,180,077	[2] 10,485.032	582,692,937	2.36	374.654	12,893	74,444	461,991	246	113,727,282	5.12

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[1] Includes coal hauled by truck to waterway for shipment by water in the following States in 1942: Alabama, 5,953 tons; Illinois, 137,461 tons; Kentucky, 617 tons; Ohio, 2,784 tons; Pennsylvania, 147,472 tons; Tennessee, 109,823 tons; and West Virginia, 317,340 tons; a grand total of 721,450 tons.

[2] Includes coal made into beehive coke at mines in the following States in 1942: Alabama, 26,756 tons; Colorado, 136,905 tons; Kentucky, 1,897 tons; Pennsylvania, 6,488,448 tons; Tennessee, 4,277 tons; Utah, 43,674 tons; Virginia, 563,356 tons; and West Virginia, 511,407 tons; grand total, 7,776,720 tons.

[3] Value received or charged for coal f. o. b. the mine, including the selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by the producer at average prices that might have been received if such coal had been sold commercially.)

[4] South Dakota includes Montana lignite.

[5] Since it is necessary to conceal certain items in the lignite break-down of disposition of coal, the figures are shown here in the column where the majority of the concealed tonnage appears.

TABLE 18.—*Number of mines, production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by districts, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto; exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Number of active mines	Disposition of coal produced (net tons)								Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Loaded at mine directly into railroad cars or river barges	Hauled by truck to railroad siding for shipment by rail and to waterway for shipment by water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Taken by locomotive tenders at tipple	Shipped by conveyor or tram to point of consumption	Used by mine employees	Used at mines for power and heat and made into beehive coke at mines [2]	Total quantity		Underground	Surface		Total			
												In strip pits	All others				
AREA 1																	
1. E. Pa.[4]	1,148	46,123,823	4,569,527	3,877,187	60,523	2,469,933	155,845	[2]906,971	58,163,809	$2.54	45,040	1,356	7,624	54,020	247	13,336,075	4.36
2. W. Pa.	723	68,391,267	[1] 2,538,846	9,841,360	174,654	1,495,583	278,596	[2] 6,132,768	88,853,074	2.44	59,033	1,869	8,878	69,780	260	18,108,581	4.91
3. N. W. Va.	304	35,290,559	[1] 2,292,177	528,572	142,291	333,123	55,295	[2] 241,029	38,883,046	2.12	19,696	511	4,031	24,238	255	6,186,294	6.29
4. Ohio	678	23,443,468	[1] 2,416,288	6,713,960	40,746	36,209	40,557	73,240	32,764,468	2.10	16,498	2,169	4,278	22,945	240	5,507,320	5.95
5. Mich.	6	69,930	------	146,472	------	------	5,393	9,353	231,148	4.42	329	------	51	380	242	91,857	2.52
6. Pan.	49	2,750,074	[1] 610,812	990,054	187,063	954,568	8,569	3,855	5,504,995	2.14	3,075	188	502	3,765	263	989,131	5.57
7. S. 1	283	62,710,518	465,393	266,609	15,194	185,536	414,567	[2] 538,479	64,596,296	2.73	48,578	69	9,205	57,852	254	14,686,172	4.40
8. S. 2	1,136	114,744,417	[1] 2,288,245	2,404,259	121,743	603,845	620,851	[2] 725,867	121,509,227	2.44	92,761	49	15,972	108,782	243	26,454,839	4.59
Total	4,327	353,524,056	15,181,288	24,768,473	742,214	6,078,797	1,579,673	8,631,562	410,506,063	2.44	285,010	6,211	50,541	341,762	250	85,360,269	4.81
AREA 2																	
9. W. Ky.	253	11,869,088	[1] 206,395	1,195,995	4,019	32,478	29,807	93,242	13,431,024	1.70	7,166	166	1,864	9,196	224	2,064,399	6.51
10. Ill.	438	55,637,795	[1] 366,013	7,732,174	40,285	191,509	223,757	879,286	65,070,819	1.91	24,296	1,774	7,313	33,383	226	7,550,499	8.62
11. Ind.	269	21,558,739	614,516	2,622,933	9,680	397,487	36,016	148,680	25,388,051	1.78	5,363	2,033	3,004	10,400	228	2,371,647	10.70
12. Iowa	191	957,563	422,618	1,520,369	------	------	31,297	15,875	2,947,722	2.85	3,466	294	581	4,341	189	820,150	3.59
Total	1,151	90,023,185	1,609,542	13,071,471	53,984	621,474	320,877	1,137,083	106,837,616	1.88	40,291	4,267	12,762	57,320	223	12,806,695	8.34
AREA 3																	
13. Southeastern	441	17,999,348	[1] 768,150	1,542,078	71,519	268,707	91,151	[2] 130,545	20,871,498	2.85	24,209	195	3,984	28,388	259	7,361,254	2.84
AREA 4																	
14. Ark-Okla.	121	1,959,866	416,368	104,547	------	------	7,841	11,969	2,500,591	3.75	3,436	140	723	4,299	195	839,135	2.98

AREA 5																	
15. Southwestern:																	
Bit.	314	7,346,390	319,807	1,895,649			26,032	47,061	9,634,939	$2.35	4,489	1,475	1,512	7,476	226	1,686,961	5.71
Lig. (Tex.)	5	286,110		1,597				3,262	290,969	.85	130	32	11	173	194	33,483	8.69
Total	319	7,632,500	319,807	1,897,246			26,032	50,323	9,925,908	2.31	4,619	1,507	1,523	7,649	225	1,720,444	5.77
AREA 6																	
16. N. Colo.	42	1,644,402	10,106	958,063		31,200	22,529	41,616	2,707,916	2.71	1,706	9	362	2,077	242	503,526	5.38
17. S. Colo.[5]	156	5,064,338	192,386	743,096	8,440	25,954	30,095	[8] 231,747	6,296,056	2.94	5,143		1,222	6,365	244	1,551,809	4.06
18. N. Mex.[6]	33	583,883	31,434	105,070	2,257		6,331	32,765	761,740	3.41	995		320	1,315	265	348,738	2.18
Total	231	7,292,623	233,926	1,806,229	10,697	57,154	58,955	[8] 306,128	9,765,712	2.91	7,844	9	1,904	9,757	246	2,404,073	4.06
AREA 7																	
19. Wyoming [7]	66	7,656,979	140,971	201,350	1,490		35,938	96,497	8,133,225	2.20	3,637	54	915	4,606	258	1,187,196	6.85
20. Utah	54	4,966,236	18,858	442,223	1,055		32,446	[8] 56,031	5,516,849	2.59	2,292		874	3,166	252	798,767	6.91
Total	120	12,623,215	159,829	643,573	2,545		68,384	152,528	13,650,074	2.36	5,929	54	1,789	7,772	256	1,985,963	6.87
AREA 8																	
21. N.-S. Dak. (lig.)	152	[9] 1,863,462	[8] [9] 47,640	[8] 598,528		[9] 94,974	[9] 105	[9] 34,835	2,590,554	1.41	502	419	314	1,235	205	252,699	10.25
AREA 9																	
22. Mont. (bit. lig.)	58	[8] 3,596,620	[8] 3,081	[8] 164,569	635	10	10,769	4,008	3,828,682	1.63	935	86	378	1,399	236	330,794	11.57

TABLE 18.—*Number of mines, production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by districts, in 1942*—Continued

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto: exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Number of active mines	Disposition of coal produced (net tons)								Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Loaded at mine directly into railroad cars or river barges	Hauled by truck to railroad siding for shipment by rail and to waterway for shipment by water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Taken by locomotive tenders at tipple	Shipped by conveyor or tram to point of consumption	Used by mine employees	Used at mines for power and heat and made into beehive coke at mines [2]	Total quantity		Underground	Surface		Total			
												In strip pits	All others				
AREA 10																	
23. Wash.[10]	45	1,234,720	100,116	549,165	38,619	----------	16,290	16,436	1,955,346	3.87	1,696	5	461	2,162	274	591,892	3.30
Alaska	7	239,556	3,169	8,553	------	----------	----------	9,615	260,893	6.22	183	------	65	248	299	74,064	3.52
Total	52	1,474,276	103,285	557,718	38,619	----------	16,290	26,051	2,216,239	4.14	1,879	5	526	2,410	276	665,956	3.33
Grand total [11]	6,972	497,989,151	[1] 18,842,916	45,154,432	920,213	7,121,116	2,180,077	[2] 10,485,032	582,692,937	2.36	374,654	12,893	74,444	461,991	246	113,727,282	5.12

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[1] Includes coal hauled by truck to waterway for shipment by water in the following districts in 1942: District 2, 147,472 tons; district 3, 165,514 tons; district 4, 2,784 tons; district 6, 30,285 tons; district 8, 121,541 tons; district 9, 617 tons; district 10, 137,461 tons; district 13, 115,776 tons; a grand total of 721,450 tons.

[2] Includes coal made into beehive coke at mines in the following districts in 1942: District 1, 471,580 tons; district 2, 6,016,868 tons; district 3, 166,001 tons; district 7, 345,406 tons; district 8, 565,253 tons; district 13, 31,033 tons; district 17, 136,905 tons; district 20, 43,674 tons; a grand total of 7,776,720 tons.

[3] Value received or charged for coal f. o. b. the mine, including the selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by the producer at average prices that might have been received if such coal had been sold commercially.)

[4] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[5] Includes Colfax County, N. Mex.

[6] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[7] Includes Idaho. No production was reported for Idaho.

[8] North and South Dakota includes Montana lignite.

[9] Since it is necessary to conceal certain items in the lignite break-down of disposition of coal, the figures are shown here in the column where the majority of the concealed tonnage appears.

[10] Includes Oregon.

[11] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

PRODUCTION BY WEEKS AND MONTHS

TABLE 19.—*Final bituminous-coal and lignite production in the United States, with estimates by weeks, in 1942*

Week ended	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 3	[1] 3,743,000	[1] 2	[2] 2,024,000	July 18	11,189,000	6	1,865,000
Jan. 10	11,283,000	6	1,881,000	July 25	11,105,000	6	1,851,000
Jan. 17	11,565,000	6	1,928,000	Aug. 1	11,276,000	6	1,879,000
Jan. 24	11,378,000	6	1,896,000	Aug. 8	11,138,000	6	1,856,000
Jan. 31	11,281,000	6	1,880,000	Aug. 15	11,424,000	6	1,904,000
Feb. 7	10,957,000	6	1,826,000	Aug. 22	11,111,000	6	1,852,000
Feb. 14	11,090,000	6	1,848,000	Aug. 29	11,559,000	6	1,927,000
Feb. 21	11,025,000	6	1,838,000	Sept. 5	11,510,000	6	1,918,000
Feb. 28	11,506,000	6	1,918,000	Sept. 12	10,735,000	5	2,147,000
Mar. 7	10,311,000	6	1,719,000	Sept. 19	11,762,000	6	1,960,000
Mar. 14	11,095,000	6	1,849,000	Sept. 26	11,631,000	6	1,939,000
Mar. 21	11,121,000	6	1,854,000	Oct. 3	11,663,000	6	1,944,000
Mar. 28	11,357,000	6	1,893,000	Oct. 10	11,716,000	6	1,953,000
Apr. 4	10,508,000	5.2	2,021,000	Oct. 17	11,613,000	6	1,936,000
Apr. 11	11,167,000	6	1,861,000	Oct. 24	11,602,000	6	1,934,000
Apr. 18	11,383,000	6	1,897,000	Oct. 31	11,829,000	6	1,972,000
Apr. 25	11,385,000	6	1,898,000	Nov. 7	11,431,000	6	1,905,000
May 2	11,186,000	6	1,864,000	Nov. 14	11,512,000	5.7	2,020,000
May 9	11,323,000	6	1,887,000	Nov. 21	11,781,000	6	1,964,000
May 16	11,385,000	6	1,898,000	Nov. 28	10,922,000	5	2,184,000
May 23	11,317,000	6	1,886,000	Dec. 5	11,392,000	6	1,899,000
May 30	11,114,000	5.3	2,097,000	Dec. 12	12,102,000	6	2,017,000
June 6	11,086,000	6	1,848,000	Dec. 19	11,880,000	6	1,980,000
June 13	11,257,000	6	1,876,000	Dec. 26	8,786,000	5	1,757,000
June 20	11,061,000	6	1,844,000	Jan. 2, 1943	[1] 7,735,000	[1] 4	[2] 1,896,000
June 27	11,380,000	6	1,897,000				
July 4	8,203,000	4	2,051,000		582,693,000	305.2	1,909,000
July 11	10,822,000	6	1,804,000				

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[1] Figures represent output and number of working days in that part of the week included in the calendar year shown. Total production for the week of Jan. 3, 1942, was 10,121,000 net tons and for Jan. 2, 1943, 9,479,000 net tons.

[2] Average daily production for the entire week and not for the working days in the calendar year shown.

TABLE 20.—*Final coal production in the United States, by States, with estimates by months, in thousands of net tons, in 1942*

[The totals for the year are based on final complete returns from all operators known to have produced more than 1,000 tons a year. The apportionment of the known yearly total among the 12 months is based upon the best information available; in some States upon direct tonnage reports by operators to the State mine departments; in most cases upon current records of railway carloadings and waterway shipments]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1, 611	1, 493	1, 645	1, 652	1, 647	1, 662	1, 625	1, 596	1, 619	1, 653	1, 487	1, 611	19, 301
Alaska	24	22	22	22	19	20	20	20	22	23	23	24	261
Arkansas	202	130	100	107	139	165	185	180	196	204	182	195	1, 985
Colorado	877	724	693	521	557	520	513	603	703	759	761	855	8, 086
Georgia	3	3	3	2	2	2	2	2	3	3	3	3	31
Illinois	5, 973	5, 451	5, 359	5, 027	5, 086	5, 230	4, 920	4, 950	5, 568	6, 022	5, 400	6, 085	65, 071
Indiana	2, 432	2, 159	2, 153	1, 958	1, 849	1, 620	2, 083	2, 005	2, 208	2, 323	2, 213	2, 385	25, 388
Iowa	343	304	264	215	178	182	187	179	211	286	292	307	2, 948
Kansas	437	347	344	308	316	299	322	364	368	383	356	386	4, 230
Kentucky:													
Eastern	3, 747	3, 258	3, 673	4, 349	4, 418	4, 287	4, 095	4, 221	4, 292	4, 391	4, 104	3, 965	48, 800
Western	1, 227	1, 124	1, 060	949	1, 020	1, 073	992	999	1, 162	1, 321	1, 214	1, 290	13, 431
Total Kentucky	4, 974	4, 382	4, 733	5, 298	5, 438	5, 360	5, 087	5, 220	5, 454	5, 712	5, 318	5, 255	62, 231
Maryland	177	165	184	197	185	185	171	167	154	157	133	126	2, 001
Michigan	32	28	21	14	14	16	11	13	20	19	19	24	231
Missouri	363	289	285	256	263	249	268	303	307	319	297	321	3, 520
Montana:													
Bituminous	358	252	294	253	208	239	287	316	348	404	380	441	3, 780
Lignite	4	3	4	3	3	3	4	4	5	5	5	6	49
Total Montana	362	255	298	256	211	242	291	320	353	409	385	447	3, 829
New Mexico	152	121	136	123	123	135	141	142	148	159	141	148	1, 669
North Dakota (lignite)	276	223	176	136	102	99	91	109	224	374	381	346	2, 537
Ohio	2, 600	2, 443	2, 766	2, 812	2, 764	2, 973	2, 795	2, 784	2, 756	2, 936	2, 607	2, 528	32, 764
Oklahoma	243	156	122	128	167	198	222	216	236	246	219	234	2, 387
Pennsylvania (bituminous)	12, 049	11, 432	12, 443	12, 279	12, 145	12, 363	12, 195	12, 020	12, 144	12, 404	11, 079	11, 520	144, 073
South Dakota (lignite)	5	5	3	2	2	2	2	2	8	8	8	7	54
Tennessee	578	638	708	730	717	716	671	681	699	719	655	646	8, 158
Texas:													
Bituminous	1	1	1	1	1	1	1	1	1	1	1	2	13
Lignite	24	18	19	19	20	23	31	29	30	28	27	23	291
Total Texas	25	19	20	20	21	24	32	30	31	29	28	25	304

Utah	532	366	422	354	421	469	467	488	482	506	480	530	5, 517
Virginia	1, 757	1, 413	1, 538	1, 783	1, 776	1, 738	1, 739	1, 614	1, 754	1, 785	1, 633	1, 606	20, 136
Washington	190	163	161	179	168	168	147	141	168	163	148	157	1, 953
West Virginia	12, 270	11, 246	12, 784	13, 638	13, 222	13, 260	13, 282	13, 246	13, 512	13, 598	12, 650	13, 174	155, 882
Wyoming	762	600	618	542	557	547	568	664	738	842	808	887	8, 133
Other States [1]	1	1	1	1	1	1	1	1	1	1	2	1	13
Total bituminous and lignite	49, 250	44, 578	48, 002	48, 560	48, 090	48, 445	48, 038	48, 060	50, 087	52, 042	47, 708	49, 833	582, 693
Pennsylvania anthracite [2]	4, 560	4, 801	5, 116	5, 185	4, 873	5, 153	5, 374	5, 212	5, 459	5, 132	4, 824	4, 639	60, 328
Grand total	53, 810	49, 379	53, 118	53, 745	52, 963	53, 598	53, 412	53, 272	55, 546	57, 174	52, 532	54, 472	643, 021

[1] Includes Arizona and Oregon.

[2] Includes Sullivan County, washery and dredge coal, local sales, colliery fuel, and coal shipped by truck from authorized operations; also includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

TABLE 21.—*Final bituminous-coal and lignite production in the United States by districts, with estimates by months, in thousands of net tons, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937, and modifications thereto. Exclusive of mines producing less than 1,000 tons a year]

[The totals for the year are based on final complete returns from all operators known to have produced more than 1,000 tons a year. The apportionment of the known yearly total among the 12 months is based on the latest information available; in some States upon direct tonnage reports from operators to the State mine departments; in most cases upon current records of railroad carloadings and waterway shipments]

Minimum price area and producing district	January	February	March	April	May	June	July	August	September	October	November	December	Total
PRICE AREA 1													
Dist. 1. Eastern Pennsylvania[1]	4, 767	4, 600	5, 020	4, 904	4, 985	5, 106	5, 021	4, 872	4, 927	4, 976	4, 481	4, 505	58, 164
Dist. 2. Western Pennsylvania	7, 542	7, 073	7, 693	7, 654	7, 424	7, 516	7, 445	7, 393	7, 447	7, 658	6, 797	7, 211	88, 853
Dist. 3. Northern West Virginia	2, 985	2, 900	3, 290	3, 387	3, 230	3, 297	3, 239	3, 342	3, 494	3, 358	3, 152	3, 209	38, 883
Dist. 4. Ohio	2, 600	2, 443	2, 766	2, 812	2, 764	2, 973	2, 795	2, 784	2, 756	2, 936	2, 607	2, 528	32, 764
Dist. 5. Michigan	32	28	21	14	14	16	11	13	20	19	19	24	231
Dist. 6. Panhandle	440	419	451	500	452	510	495	575	446	424	390	403	5, 505
Dist. 7. Southern numbered 1	5, 288	4, 703	5, 204	5, 600	5, 499	5, 390	5, 470	5, 380	5, 505	5, 612	5, 173	5, 772	64, 596
Dist. 8. Southern numbered 2	9, 423	8, 336	9, 535	10, 800	10, 740	10, 598	10, 370	10, 260	10, 604	10, 900	10, 132	9, 812	121, 510
Total, price area 1	33, 077	30, 502	33, 980	35, 671	35, 108	35, 406	34, 846	34, 619	35, 199	35, 883	32, 751	33, 464	410, 506
PRICE AREA 2													
Dist. 9. West Kentucky	1, 227	1, 124	1, 060	949	1, 020	1, 073	992	999	1, 162	1, 321	1, 214	1, 290	13, 431
Dist. 10. Illinois	5, 973	5, 451	5, 359	5, 027	5, 086	5, 230	4, 920	4, 950	5, 568	6, 022	5, 400	6, 085	65, 071
Dist. 11. Indiana	2, 432	2, 159	2, 153	1, 958	1, 849	1, 620	2, 083	2, 005	2, 208	2, 323	2, 213	2, 385	25, 388
Dist. 12. Iowa	343	304	264	215	178	182	187	179	211	286	292	307	2, 948
Total, price area 2	9, 975	9, 038	8, 836	8, 149	8, 133	8, 105	8, 182	8, 133	9, 149	9, 952	9, 119	10, 067	106, 838
PRICE AREA 3													
Dist. 13. Southeastern	1, 747	1, 617	1, 785	1, 785	1, 782	1, 796	1, 740	1, 725	1, 754	1, 782	1, 619	1, 739	20, 871
PRICE AREA 4													
Dist. 14. Arkansas-Oklahoma	255	164	127	134	175	207	233	226	247	257	229	246	2, 500
PRICE AREA 5													
Dist. 15. Southwestern:													
Bituminous coal	991	759	725	666	711	705	765	838	861	896	826	892	9, 635
Lignite (Texas)	24	18	19	19	20	23	31	29	30	28	27	23	291
Total, price area 5	1, 015	777	744	685	731	728	796	867	891	924	853	915	9, 926

PRICE AREA 6													
Dist. 16. Northern Colorado	346	306	250	157	141	104	111	170	253	275	265	330	2,708
Dist. 17. Southern Colorado [2]	610	485	517	432	484	491	480	512	532	572	574	607	6,296
Dist. 18. New Mexico [3]	74	55	63	56	56	60	64	64	67	72	64	67	762
Total, price area 6	1,030	846	830	645	681	655	655	746	852	919	903	1,004	9,766
PRICE AREA 7													
Dist. 19. Wyoming [4]	762	600	618	542	557	547	568	664	738	842	808	887	8,133
Dist. 20. Utah	532	366	422	354	421	469	467	488	482	506	480	530	5,517
Total, price area 7	1,294	966	1,040	896	978	1,016	1,035	1,152	1,220	1,348	1,288	1,417	13,650
PRICE AREA 8													
Dist. 21. North-South Dakota (lignite)	281	228	179	138	104	101	93	111	232	382	389	353	2,591
PRICE AREA 9													
Dist. 22. Montana (bituminous and lignite)	362	255	298	256	211	242	291	320	353	409	385	447	3,829
PRICE AREA 10													
Dist. 23. Washington [5]	190	163	161	179	168	169	147	141	168	163	149	157	1,955
Alaska	24	22	22	22	19	20	20	20	22	23	23	24	261
Total, price area 10	214	185	183	201	187	189	167	161	190	186	172	181	2,216
Grand total [6]	49,250	44,578	48,002	48,560	48,090	48,445	48,038	48,060	50,087	52,042	47,708	49,833	582,693

[1] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[2] Includes Colfax County, N. Mex.

[3] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[4] Includes Idaho. No production was reported for Idaho.

[5] Includes Oregon.

[6] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

NUMBER AND SIZE OF MINES

TABLE 22.—*Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1942*

[Exclusive of mines producing less than 1,000 tons]

State	Class 1A, more than 500,000 tons					Class 1B, 200,000 to 500,000 tons					Class 2, 100,000 to 200,000 tons				
	Mines		Production			Mines		Production			Mines		Production		
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent
Alabama	11	3.9	7, 886, 611	716, 965	40.9	18	4.8	5, 219, 367	289, 965	27.0	22	5.9	3, 270, 441	148, 656	16.9
Alaska											1	14.3	114, 933	114, 933	44.1
Arizona															
Arkansas											4	4.8	431, 790	107, 948	21.7
Colorado	1	5	630, 933	630, 933	7.8	9	4.8	2, 347, 293	260, 810	29.0	14	7.4	2, 104, 103	150, 293	26.0
Georgia															
Illinois	54	12.3	49, 544, 489	917, 491	76.2	21	4.8	7, 501, 267	357, 203	11.5	19	4.3	2, 617, 679	137, 773	4.0
Indiana	17	6.3	14, 250, 977	838, 293	56.1	22	8.2	6, 343, 865	288, 358	25.0	16	5.9	2, 164, 798	135, 300	8.5
Iowa						1	.5	208, 316	208, 316	7.1	6	3.2	754, 832	125, 805	25.6
Kansas	2	2.3	1, 226, 186	613, 093	29.0	6	6.9	1, 899, 716	316, 619	44.9	3	3.5	511, 878	170, 626	12.1
Kentucky	26	2.9	20, 255, 109	779, 043	32.6	77	8.6	22, 198, 612	288, 294	35.7	71	7.9	10, 670. 041	150, 282	17.2
Maryland						2	2.0	517, 365	258, 683	25.9	1	1.0	172, 336	172, 336	8.6
Michigan											1	16.7	141, 963	141, 963	61.4
Missouri	1	.6	507, 772	507, 772	14.4	4	2.5	1, 236, 338	309, 085	35.1	3	1.8	392, 686	130, 895	11.2
Montana (bituminous)	2	4.8	2, 208, 330	1, 104, 165	58.4	2	4.8	800, 968	400, 484	21.2	3	7.1	563, 543	187, 848	14.9
Montana, North Dakota, South Dakota, and Texas (lignite)						6	3.5	1, 865, 461	310, 910	63.7	2	1.1	298, 466	149, 233	10.2
New Mexico						3	7.7	1, 016, 470	338, 823	60.9	2	5.1	263. 553	131, 777	15.8
Ohio	15	2.2	14, 410, 121	960, 675	44.0	22	3.2	6, 971, 208	316, 873	21.3	26	3.8	3, 820, 240	146, 932	11.6
Oklahoma						2	2.1	650, 558	325, 279	27.3	4	4.1	619, 016	154, 754	25.9
Oregon															
Pennsylvania	80	4.6	78, 535, 304	981, 691	54.5	79	4.5	25, 071, 428	317, 360	17.4	122	7.0	17, 334, 655	142, 087	12.0
Tennessee	1	.6	532, 372	532, 372	6.5	12	6.9	3, 589, 403	299, 117	44.0	13	7.5	1, 975, 467	151, 959	24.2
Texas (bituminous)															
Utah	3	5.5	2, 669, 745	889, 915	48.4	5	9.3	1, 626, 610	325, 322	29.5	5	9.3	731, 231	146, 246	13.3
Virginia	11	7.2	9, 166, 103	833, 282	45.5	25	16.4	7, 742, 892	309, 716	38.5	13	8.6	1, 897, 474	145, 960	9.4
Washington						3	7.0	802, 517	267, 506	41.1	4	9.3	531, 620	132, 905	27.2
West Virginia	85	9.5	73, 470, 462	864, 358	47.1	172	19.2	55, 031, 274	319, 949	35.3	123	13.7	17, 697, 632	143, 883	11.4
Wyoming	7	10.6	5, 253, 209	750, 458	64.6	4	6.1	1. 216, 005	304, 001	15.0	6	9.1	906, 234	151, 039	11.1
Total	316	4.5	280, 547, 723	887, 809	48.2	495	7.1	153, 856, 933	310, 822	26.4	484	6.9	69, 986, 611	144, 600	12.0

State	Class 3, 50,000 to 100,000 tons					Class 4, 10,000 to 50,000 tons					Class 5, less than 10,000 tons					Total		
	Mines		Production			Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent		Total	Average per mine
Alabama	15	4.0	1,136,127	75.742	5.9	43	11.6	994,578	23,130	5.2	263	70.7	794,130	3.020	4.1	372	19,301,254	51,885
Alaska	2	28.6	128,735	64,368	49.3						4	57.1	17,225	4,306	6.6	7	260,893	37,270
Arizona											4	100.0	11,373	2,843	100.0	4	11,373	2,843
Arkansas	12	14.3	815,726	67,977	41.1	25	29.7	613,513	24,541	30.9	43	51.2	124,364	2,892	6.3	84	1,985,393	23,636
Colorado	22	11.7	1,638,037	74,456	20.3	40	21.3	978,389	24,460	12.1	102	54.3	386,925	3,793	4.8	188	8,085,680	43,009
Georgia						1	100.0	30,913	30,913	100.0						1	30,913	30,913
Illinois	26	5.9	1,883,126	72,428	2.9	115	26.3	2,726,789	23,711	4.2	203	46.4	797,469	3,928	1.2	438	65,070,819	148,564
Indiana	12	4.5	880,047	73,337	3.5	60	22.3	1,240,878	20,681	4.9	142	52.8	507,486	3,574	2.0	269	25,398,051	94,379
Iowa	5	2.6	412,515	82,503	14.0	56	29.3	1.051.647	18,779	35.7	123	64.4	520.412	4,231	17.6	191	2,947,722	15,433
Kansas						19	21.8	381,125	20,059	9.0	57	65.5	210 953	3.701	5.0	87	4,229,858	48,619
Kentucky	62	6.9	4,570,854	73.723	7.3	140	15.6	2,827,024	20,193	4.5	522	58.1	1,709,126	3,274	2.7	898	62,230,766	69,299
Maryland	8	7.8	607.005	75,876	30.3	23	22.5	497,839	21,645	24.9	68	66.7	206,389	3,035	10.3	102	2,000,934	19,617
Michigan						5	83.3	89,185	17.837	38.6						6	231,148	38,525
Missouri	3	1.8	176,435	58,812	5.0	34	20.9	769.690	22,638	21.9	118	72.4	436,956	3,703	12.4	163	3,519,877	21,594
Montana (bituminous)	1	2.4	51,250	51.250	1.4	5	11.9	70,331	14,066	1.9	29	69.0	85,122	2,935	2.2	42	3,779.544	89,989
Montana, North Dakota, South Dakota, and Texas (lignite)	2	1.2	176,124	88.062	6.0	15	8.7	311,428	20,762	10.6	148	85.5	279,182	1,886	9.5	173	2,930,661	16,940
New Mexico	2	5.1	129,085	64,543	7.7	8	20.5	186,600	23,325	11.2	24	61.6	72,951	3,040	4.4	39	1.668,659	42,786
Ohio	35	5.2	2,677,264	76.493	8.2	145	21.4	3.407,709	23,501	10.4	435	64.2	1,477.926	3,398	4.5	678	32,764.468	48,325
Oklahoma	6	6.1	415,801	69.300	17.4	21	21.4	475,530	22,644	19.9	65	66.3	226.287	3.481	9.5	98	2,387,192	24,359
Oregon											2	100.0	2,137	1,069	100.0	2	2,137	1.069
Pennsylvania	128	7.3	8,782,120	68,610	6.1	496	28.5	11,145,865	22,472	7.8	837	48.1	3,203,817	3,828	2.2	1,742	144.073.189	82,706
Tennessee	14	8.0	979.358	69,954	12.0	31	17.8	733,587	23.664	9.0	103	59.2	348 050	3,379	4.3	174	8,158.237	46,886
Texas (bituminous)						1	33.3	10,253	10.253	77.6	2	66.7	2,957	1,479	22.4	3	13,210	4,403
Utah	2	3.7	121,435	60,718	2.2	12	22.2	271,153	22,596	4.9	27	50.0	96,675	3,581	1.7	54	5,516.849	102,164
Virginia	8	5.3	636,471	79,559	3.2	18	11.8	382,762	21,265	1.9	77	50.7	310,477	4.032	1.5	152	20,136,179	132,475
Washington	4	9.3	295,346	73 837	15.1	11	25.6	231,354	21.032	11.9	21	48.8	92,372	4,399	4.7	43	1,953,209	45,423
West Virginia	69	7.7	4,849,529	70,283	3.1	159	17.8	3,807.679	23,948	2.4	288	32.1	1,024,921	3,559	.7	896	155,881,497	173,975
Wyoming	7	10.6	469,076	67,011	5.8	9	13.6	164,704	18,300	2.0	33	50.0	123,997	3,757	1.5	66	8,133,225	123,231
Total	445	6.4	31,831,466	71,531	5.5	1,492	21.4	33,400,525	22,386	5.7	3,740	53.7	13,069,679	3,495	2.2	6,972	582,692,937	83,576

TABLE 23.—*Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each district, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto; exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Class 1A, more than 500,000 tons					Class 1B, 200,000 to 500,000 tons					Class 2, 100,000 to 200,000 tons				
	Mines		Production			Mines		Production			Mines		Production		
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent
PRICE AREA 1															
Dist. 1. Eastern Pennsylvania [1]	25	2.2	20,846,440	833,858	35.8	45	3.9	14,013,275	311,406	24.1	64	5.6	8,799,732	137,496	15.1
Dist. 2. Western Pennsylvania	55	7.6	57,688,864	1,048,888	64.9	36	5.0	11,575,518	321,542	13.0	63	8.7	9,276,934	147,253	10.5
Dist. 3. Northern West Virginia	24	7.9	23,257,543	969,064	59.8	26	8.6	8,529,699	328,065	21.9	26	8.6	3,551,486	136,596	9.1
Dist. 4. Ohio	15	2.2	14,410,121	960,675	44.0	22	3.2	6,971,208	316,873	21.3	26	3.8	3,820,240	146,932	11.6
Dist. 5. Michigan	------	------	------	------	------	------	------	------	------	------	1	16.7	141,963	141,963	61.4
Dist. 6. Panhandle	3	6.1	2,312,479	770,826	42.0	6	12.2	2,064,063	344,011	37.5	3	6.1	395,973	131,991	7.2
Dist. 7. Southern numbered 1	37	13.1	31,879,887	861,619	49.4	73	25.8	24,509,644	335,749	37.9	35	12.4	5,129,419	146,555	7.9
Dist. 8. Southern numbered 2	53	4.7	41,545,127	783,870	34.2	165	14.5	48,739,252	295,389	40.1	132	11.6	19,577,291	148,313	16.1
Total, price area 1	212	4.9	191,940,461	905,380	46.8	373	8.6	116,402,659	312,071	28.4	350	8.1	50,693,038	144,837	12.3
PRICE AREA 2															
Dist. 9. West Kentucky	5	2.0	3,896,638	779,328	29.0	15	5.9	4,287,743	285,850	31.9	20	7.9	3,016,770	150,839	22.5
Dist. 10. Illinois	54	12.3	49,544,489	917,491	76.2	21	4.8	7,501,267	357,203	11.5	19	4.3	2,617,679	137,773	4.0
Dist. 11. Indiana	17	6.3	14,250,977	838,293	56.1	22	8.2	6,343,865	288,358	25.0	16	5.9	2,164,798	135,300	8.5
Dist. 12. Iowa	------	------	------	------	------	1	.5	208,316	208,316	7.1	6	3.2	754,832	125,805	25.6
Total, price area 2	76	6.6	67,692,104	890,686	63.3	59	5.1	18,341,191	310,868	17.2	61	5.3	8,554,079	140,231	8.0
PRICE AREA 3															
Dist. 13. Southeastern	12	2.7	8,418,983	701,582	40.3	19	4.3	5,651,147	297,429	27.1	22	5.0	3,270,441	148,656	15.7
PRICE AREA 4															
Dist. 14. Arkansas-Oklahoma	------	------	------	------	------	------	------	------	------	------	4	3.3	431,790	107,948	17.3
PRICE AREA 5															
Dist. 15. Southwestern:															
Bituminous	3	1.0	1,733,958	577,986	18.0	12	3.8	3,786,612	315,551	39.3	10	3.2	1,523,580	152,358	15.8
Lignite (Texas)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

PRICE AREA 6															
Dist. 16. Northern Colorado						3	7.1	788,577	262,859	29.1	8	19.1	1,160,586	145,073	42.9
Dist. 17. Southern Colorado [3]	1	0.6	630,933	630,933	10.0	8	5.1	2,238,820	279,853	35.6	7	4.5	1,094,346	156,335	17.4
Dist. 18. New Mexico [4]						1	3.0	336,366	336,366	44.1	1	3.0	112,724	112,724	14.8
Total, price area 6	1	.4	630,933	630,933	6.5	12	5.2	3,363,763	280,314	34.4	16	6.9	2,367,656	147,979	24.3
PRICE AREA 7															
Dist. 19. Wyoming [5]	7	10.6	5,253,209	750,458	64.6	4	6.1	1,216,005	304,001	15.0	6	9.1	906,234	151,039	11.1
Dist. 20. Utah	3	5.5	2,669,745	889,915	48.4	5	9.3	1,626,610	325,322	29.5	5	9.3	731,231	146,246	13.3
Total, price area 7	10	8.3	7,922,954	792,295	58.1	9	7.5	2,842,615	315,846	20.8	11	9.2	1,637,465	148,860	12.0
PRICE AREA 8															
Dist. 21. North-South Dakota (lignite)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
PRICE AREA 9															
Dist. 22. Montana [5]	2	4.8	2,208,330	1,104,165	58.4	2	4.8	800,968	400,484	21.2	3	7.1	563,543	187,848	14.9
PRICE AREA 10															
Dist. 23. Washington [6]						3	6.7	802,517	267,506	41.1	4	8.9	531,620	132,905	27.2
Alaska											1	14.3	114,933	114,933	44.1
Total, price area 10						3	5.8	802,517	267,506	36.2	5	9.6	646,553	129,311	29.2
Total of above	316	4.7	280,547,723	887,809	48.4	489	7.2	151,991,472	310,821	26.2	482	7.1	69,688,145	144,581	12.0
Total lignite [3]						6	3.5	1,865,461	310,910	63.7	2	1.1	298,466	149,233	10.2
Grand total [7]	316	4.5	280,547,723	887,809	48.2	495	7.1	153,856,933	310,822	26.4	484	6.9	69,986,611	144,600	12.0

See footnotes at end of table.

TABLE 23.—*Number and production of bituminous-coal and lignite mines in the United States, classified by size of outputi n each district, in 1942*—Continued

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto; exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Class 3, 50,000 to 100,000 tons					Class 4, 10,000 to 50,000 tons					Class 5, less than 10,000 tons					Total		
	Mines		Production			Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent		Total	Average per mine
PRICE AREA 1																		
Dist. 1. Eastern Pennsylvania [1]	81	7.0	5,439,320	67,152	9.4	319	27.8	6,834,894	21,426	11.8	614	53.5	2,230,148	3,632	3.8	1,148	58,163,809	50,665
Dist. 2. Western Pennsylvania	58	8.0	4,170,937	71,913	4.7	204	28.2	4,903,839	24,038	5.5	307	42.5	1,236,982	4,029	1.4	723	88,853,074	122,895
Dist. 3. Northern West Virginia	19	6.2	1,345,131	70,796	3.5	75	24.7	1,756,798	23,424	4.5	134	44.0	442,389	3,301	1.2	304	38,883,046	127,905
Dist. 4. Ohio	35	5.2	2,677,264	76,493	8.2	145	21.4	3,407,709	23,501	10.4	435	64.2	1,477,926	3,398	4.5	678	32,764,468	48,325
Dist. 5. Michigan	-----	-----	-----	-----	-----	5	83.3	89,185	17,837	38.6	-----	-----	-----	-----	-----	6	231,148	38,525
Dist. 6. Panhandle	7	14.3	451,807	64,544	8.2	11	22.5	195,611	17,783	3.5	19	38.8	85,062	4,477	1.5	49	5,504,995	112,347
Dist. 7. Southern numbered 1	25	8.8	1,844,116	73,765	2.9	41	14.5	950,847	23,191	1.5	72	25.4	282,383	3,922	.4	283	64,596,296	228,255
Dist. 8. Southern numbered 2	84	7.4	6,083,411	72,422	5.0	166	14.6	3,786,973	22,813	3.1	536	47.2	1,777,173	3,316	1.5	1,136	121,509,227	106,962
Total, price area 1	309	7.2	22,011,986	71,236	5.4	966	22.3	21,925,856	22,698	5.3	2,117	48.9	7,532,063	3,558	1.8	4,327	410,506,063	94,871
PRICE AREA 2																		
Dist. 9. West Kentucky	13	5.1	975,968	75,074	7.3	39	15.4	703,691	18,043	5.2	161	63.7	550,214	3,417	4.1	253	13,431,024	53,087
Dist. 10. Illinois	26	5.9	1,883,126	72,428	2.9	115	26.3	2,726,789	23,711	4.2	203	46.4	797,469	3,928	1.2	438	65,070,819	148,564
Dist. 11. Indiana	12	4.5	880,047	73,337	3.5	60	22.3	1,240,878	20,681	4.9	142	52.8	507,486	3,574	2.0	269	25,388,051	94,379
Dist. 12. Iowa	5	2.6	412,515	82,503	14.0	56	29.3	1,051,647	18,779	35.7	123	64.4	520,412	4,231	17.6	191	2,947,722	15,433
Total, price area 2	56	4.9	4,151,656	74,137	3.9	270	23.5	5,723,005	21,196	5.4	629	54.6	2,375,581	3,777	2.2	1,151	106,837,616	92,822
PRICE AREA 3																		
Dist. 13. Southeastern	17	3.9	1,250,774	73,575	6.0	56	12.7	1,287,594	22,993	6.2	315	71.4	992,559	3,151	4.7	441	20,871,498	47,328
PRICE AREA 4																		
Dist. 14. Arkansas-Oklahoma	15	12.4	1,006,009	67,067	40.2	33	27.3	824,202	24,976	33.0	69	57.0	238,590	3,458	9.5	121	2,500,591	20,666

PRICE AREA 5																		
Dist. 15. Southwestern:																		
Bituminous	6	1.9	401, 953	66, 992	4. 2	67	21. 3	1, 425, 909	21, 282	14. 8	216	68. 8	762, 927	3, 532	7. 9	314	9, 634, 939	30, 685
Lignite (Texas)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
PRICE AREA 6																		
Dist. 16. Northern Colorado	7	16. 7	482, 562	68, 937	17. 8	9	21. 4	216, 227	24, 025	8. 0	15	35. 7	59, 964	3, 998	2. 2	42	2, 707, 916	64, 474
Dist. 17. Southern Colorado [3]	16	10. 3	1, 228, 276	76, 767	19. 5	31	19. 9	762, 162	24. 586	12. 1	93	59. 6	341, 519	3, 672	5. 4	156	6, 296, 056	40, 359
Dist. 18. New Mexico [4]	1	3. 0	56, 284	56, 284	7. 4	8	24. 3	186, 600	23. 325	24. 5	22	66. 7	69, 766	3, 171	9. 2	33	761. 740	23, 083
Total price area 6	24	10. 4	1, 767, 122	73, 630	18. 1	48	20. 8	1, 164, 989	24, 271	11. 9	130	56. 3	471, 249	3, 625	4. 8	231	9, 765. 712	42, 276
PRICE AREA 7																		
Dist. 19. Wyoming [5]	7	10. 6	469, 076	67, 011	5. 8	9	13. 6	164, 704	18, 300	2. 0	33	50. 0	123, 997	3, 757	1. 5	66	8, 133, 225	123, 231
Dist. 20. Utah	2	3. 7	121, 435	60. 718	2. 2	12	22. 2	271, 153	22, 596	4. 9	27	50. 0	96, 675	3, 581	1. 7	54	5, 516, 849	102, 164
Total, price area 7	9	7. 5	590, 511	65, 612	4. 3	21	17. 5	435, 857	20, 755	3. 2	60	50. 0	220, 672	3, 678	1. 6	120	13, 650, 074	113, 751
PRICE AREA 8																		
Dist. 21. North-South Dakota (lignite)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
PRICE AREA 9																		
Dist. 22. Montana [2]	1	2. 4	51, 250	51, 250	1. 4	5	11. 9	70, 331	14, 066	1. 9	29	69. 0	85, 122	2, 935	2. 2	42	3, 779, 544	89, 989

Footnotes at end of table.

TABLE 23.—*Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each district, in 1942*—Continued

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto; exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Class 3, 50,000 to 100,000 tons					Class 4, 10,000 to 50,000 tons					Class 5, less than 10,000 tons					Total		
	Mines		Production			Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent		Total	Average per mine
PRICE AREA 10																		
Dist. 23. Washington [6]	4	8.9	295,346	73,837	15.1	11	24.4	231,354	21,032	11.8	23	51.1	94.509	4,109	4.8	45	1,955,346	43,452
Alaska	2	28.6	128,735	64,368	49.3						4	57.1	17,225	4,306	6.6	7	260,893	37,270
Total, price area 10	6	11.5	424,081	70,680	19.1	11	21.2	231,354	21,032	10.4	27	51.9	111,734	4,138	5.1	52	2,216,239	42,620
Total of above	443	6.5	31,655,342	71,457	5.5	1,477	21.7	33,089.097	22,403	5.7	3,592	52.8	12,790,497	3,561	2.2	6,799	579,762,276	85,272
Total lignite [2]	2	1.2	176,124	88,062	6.0	15	8.7	311,428	20,762	10.6	148	85.5	279,182	1,886	9.5	173	2,930,661	16,940
Grand total [7]	445	6.4	31,831,466	71,531	5.5	1,492	21.4	33,400,525	22,386	5.7	3,740	53.7	13,069.679	3,495	2.2	6,972	582,692,937	83,576

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[1] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[2] Data for lignite by classes in Montana, North Dakota, South Dakota, and Texas are not available for the separate States, but are shown at end of table in combined form as "Total lignite."

[3] Includes Colfax County, N. Mex.

[4] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[5] Includes Idaho. No production was reported for Idaho.

[6] Includes Oregon.

[7] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

AVERAGE VALUE

Before the Bituminous Coal Act of 1937 was passed, the most valuable single index of the trend of prices at the mines was the "average value per ton, f. o. b. mines," as given in the familiar annual coal reports of the Bureau of Mines, United States Department of the Interior. This series was referred to in Bureau of Mines reports as representing "bituminous coal," and it covered all coal (other than Pennsylvania anthracite) produced in the United States. It represented the bituminous-coal industry as the term ordinarily was used in the trade and included the lignite of the Dakotas, Texas, and Montana, as well as any small tonnages of hard coal produced outside of Pennsylvania.

With the passage of the Coal Act, the Bureau of Mines relinquished the collection of statistics relating to bituminous coal, effective June 30, 1937, though continuing to compile data regarding lignite and Pennsylvania anthracite. Effective the same date, the Coal Commission became responsible for the compilation of data on bituminous coal, though not attempting to collect data regarding lignite, which was specifically exempted by the act. The records of the Commission (later the Bituminous Coal Division, United States Department of the Interior) relate to all coal other than Pennsylvania anthracite, Virginia semianthracite, and lignite.

To permit comparison of the old and new series, therefore, it is necessary to separate the lignites from the bituminous coals, though for the convenience of the student the combined average for the two is continued in a form as nearly comparable as possible to the old series (see table 24).

A more important change in the two series relates to the treatment of selling expenses. The old Bureau of Mines series of "value at the mines" excluded the selling cost. Reporting operators were asked to state the "Amount received at the mines f. o. b. cars less the selling expense." No details were asked regarding the items included in the value, and no systematic effort was made to follow up the exclusion of selling expenses. It was realized at the time that some producers might find it impractical to exclude selling costs and that some part of the selling expenses of the industry might be included in the results. Nevertheless, the reports were checked for consistency from year to year, the questions were retained in the same form without change, and the results are believed to have been comparable from one year to the next. The new series of the Coal Commission represents the total or gross realization on all coal produced and specifically includes the selling cost.

The two sets of data may not be precisely comparable with respect to coal produced but not sold on the commercial market. In the Bureau of Mines series reporting operators were instructed that the "Value of coal not sold but used by producer, also mine fuel and coal made into coke should be estimated at average prices that might have been received." The instructions of the Coal Commission regarding such items were in effect similar, though given in greater detail.

A comparison of the two series is possible for 1936. In that year the average value per ton on the old (Bureau of Mines) basis amounted to $1.761 per ton for bituminous coal, excluding lignite. The average gross realization, according to data collected by the Coal Commission, was $1.831 per ton. The difference amounts to $0.07 per ton—an amount somewhat less than the average selling expenditures computed per ton of all coal produced, as reported to the Coal Commission. The comparison confirms previous indications that the great majority of operators reporting in earlier years had followed instructions and omitted selling expenses in computing the average value but that some of them had included the selling expense. The change in method of reporting should be kept in mind in comparing the two sets of data. As the reports to the Commission were submitted on a detailed accounting return, and made under oath they are to be accepted. The returns of earlier years, upon a voluntary basis and not in all instances uniform as to treatment of selling costs, seem to have been thoroughly comparable from one year to the next and afford the best available index to the rise and fall of the mine prices received by operators down to 1936.

TABLE 24.—*Trend of average value in the United States of bituminous coal and lignite per ton, f. o. b. mines, 1929–42*

Year	Bituminous coal (subject to regulation under 1937 act[1]	Lignite[2]	Total
Average value per ton less selling cost:			
1929	$1.782	$1.548	$1.781
1930	1.702	1.556	1.701
1931	1.542	1.410	1.541
1932	1.313	1.313	1.313
1933	1.337	1.188	1.336
1934	1.751	1.387	1.749
1935	1.772	1.120	1.767
1936	1.761	1.061	1.756
Average gross realization, selling cost not deducted:			
1936	1.831	[3] 1.061	1.826
1937	1.946	[3] 1.080	1.939
1938	1.955	[3] 1.071	1.947
1939[4]	1.850	1.158	1.845
1940	1.913	[3] 1.156	1.908
1941	2.194	1.237	2.189
1942	2.363	1.364	2.358

[1] Includes all coal produced other than Pennsylvania anthracite and the lignite included in the second column.

[2] North Dakota, South Dakota, and the lignite counties of Montana and Texas.

[3] Figures for 1936–38 and 1940 exclude selling cost as before.

[4] Producers were asked to exclude selling cost in reporting value, but a number of them included such costs.

LABOR STATISTICS

Men employed.—An average of 461,991 men was employed at bituminous-coal mines in 1942, a 1.1-percent increase over the total of 456,981 for 1941 (see fig. 10). Statistics on men employed in 1941 represent annual averages of the number of workers on the rolls on the days when the mines were in operation.

The method used here in calculating employment gives an accurate measure of the working force in the coal industry, but it does not consider the time lost by men on the rolls through intermittent operations. To measure the influence of intermittency upon employment the factor of mine activity as indicated by the average number of days of plant operation was recorded separately. The average number of men employed when the mines were in operation was then used, in conjunction with the average number of days of operation, as a measure of the total volume of employment in the industry.

Days operated.—The average number of days of operation at bituminous-coal mines in 1942 was 246. This represents an increase over the average of 216 days for 1941. All statistics on days of mine operation included in this report are weighted averages, in which the operating time of each mine has been weighted by the number of its employees. Several coal-mining States publish series on the number of days worked that are simple averages of the figures for each reporting mine, regardless of size. As these unweighted averages are likely to be unduly depressed by small mines, which generally operate fewer days than the larger ones, they tend to understate the working time of a typical mine employee.

Man-days of labor.—Only a small proportion of the bituminous-coal-mine operations, however, keep an accurate record of man-days or man-hours worked. Consequently, man-days have been computed by multiplying the number of workers employed by the number of operating days. Although these computations were made for each individual mine, the combined total is necessarily only an approximation.

Until the American coal industry arranges to keep an accurate record of man-days or man-hours of employment all computations of accident rates, daily earnings, and output per man will remain subject to qualification. Meanwhile, the method of multiplying men by days must be accepted as the best available procedure.

Data for 1942 indicate that bituminous-coal-mine employees performed 113,727,282 man-days of labor during the year. Table 17 gives a summary record of men employed, days operated, and output per man per day at bituminous-coal mines, by States, in 1942. Details by counties for 1942 are shown in table 54.

Length of working day.—Table 25 summarizes the replies of mine operators to the question, "Number of hours operated per shift."

The reports of more than 7 hours of work per shift in 1942 consist partly of (1) work for which the operator has included time when the men are entering or leaving the mine, (2) work for which the operator has reported the time of certain employees who work longer than other employees, as in stripping overburden, or (3) operations where work is staggered and two crews of men overlap. There were, however, a number of mines in 1942 where the established day was 8 hours. As shown by the table, most of these were very small. Numerous mines, especially the smaller ones, failed to answer the question.

It was found that 90.5 percent of the men employed were in 7-hour mines and that the weighted average working shift was 7.05 hours.

The established working day does not of itself measure the length of time that men actually work or the time that they are underground, because of the possibility of overtime, because the mine may sometimes shut down before the full day is over, because the miner may go home before the mine stops, and because he spends a considerable time going to and from his place of work underground.

As interpreted in the wage agreements, the 7-hour day means 7 hours of labor at the usual working place, exclusive of any time for lunch and exclusive of the time spent in going from the entrance of the mine to the working place and back again. As noted, these figures represent the operator's statement of the nominal operating day for the mine. They do not purport to represent the time actually worked by the men. On the one hand, they make no allowance for tonnage or piece workers who leave early; on the other hand, they make no allowance for tonnage men who continue at work after the mine as a whole is shut down, or who go into the mine to work on days when the tipple is idle.

TABLE 25.—*Number of bituminous-coal and lignite mines in the United States having established working shift of certain length and number of men employed therein, in 1942*

State	7 hours		8 hours		9 hours		All others [1]		Total	
	Mines	Men	Mines	Men	Mines	Men	Mines	Men	Mines	Men
Alabama	320	22,937	46	3,127	1	9	5	80	372	26,153
Alaska	1	12	5	160			1	76	7	248
Arizona			4	29					4	29
Arkansas	70	3,225	10	132			4	36	84	3,393
Colorado	151	7,329	23	166			14	210	188	7,705
Georgia			1	112					1	112
Illinois	308	29,080	76	806	1	5	53	3,492	438	33,383
Indiana	115	5,511	75	651	2	12	77	4,226	269	10,400
Iowa	109	3,369	57	710	6	64	19	198	191	4,341
Kansas	31	1,133	39	430			17	900	87	2,463
Kentucky:										
Eastern	390	45,491	244	4,234	2	8	9	483	645	50,216
Western	158	7,871	83	760			12	565	253	9,196
Total Kentucky	548	53,362	327	4,994	2	8	21	1,048	898	59,412
Maryland	97	2,280	5	117					102	2,397
Michigan	6	380							6	380
Missouri	63	1,633	82	1,364	5	63	13	451	163	3,511
Montana:										
Bituminous	29	1,182	9	113	2	4	2	18	42	1,317
Lignite	2	20	10	46	(2)	(2)	[2] 4	[2] 16	16	82
Total Montana	31	1,202	19	159	2	4	6	34	58	1,399
New Mexico	22	1,849	15	152			2	22	39	2,023
North Dakota (lignite)	10	83	60	589	8	36	63	476	141	1,184
Ohio	442	18,834	183	2,410	4	50	49	1,651	678	22,945
Oklahoma	72	1,809	17	190			9	355	98	2,354
Oregon			2	8					2	8
Pennsylvania	1,438	114,305	186	2,231	18	194	100	3,661	1,742	120,391
South Dakota (lignite)	(3)	(3)	[3] 6	[3] 39	(2)	(2)	[2] 5	[2] 12	11	51
Tennessee	140	8,580	30	804			4	234	174	9,618
Texas:										
Bituminous			3	54					3	54
Lignite			3	161	(2)	(2)	[2] 2	[2] 12	5	173
Total Texas			6	215			2	12	8	227
Utah	45	3,087	9	79					54	3,166
Virginia	109	18,606	40	787			3	23	152	19,416
Washington	43	2,154							43	2,154
West Virginia	786	112,834	81	1,033	3	123	26	4,532	896	118,522
Wyoming	57	4,550	6	20	1	3	2	33	66	4,606
Total	5,014	418,144	1,410	21,514	53	571	495	21,762	6,972	461,991

[1] Includes mines where the day was more than 9 or less than 7 hours; also includes many small mines that failed to answer the question.

[2] Mines and men working "9 hours" included under "all others."

[3] Mines and men working "7 hours" included under "8 hours."

TABLE 26.—*Strikes, suspensions, and lock-outs in bituminous-coal and lignite mines in the United States, by States, in 1942*

State	Number of men employed	Number of men on strike	Man-days idle on account of strike	Average number of days lost on account of strike	
				Per man employed	Per man on strike
Alabama	26,153	5,840	51,297	2	9
Alaska	248				
Arizona	29				
Arkansas	3,393	488	4,880	1	10
Colorado	7,705	224	224	(1)	1
Georgia	112				
Illinois	33,383	2,829	18,864	1	7
Indiana	10,400	3,788	64,058	6	17
Iowa	4,341	436	1,077	(1)	2
Kansas	2,463	34	650	(1)	19
Kentucky	59,412	6,908	47,905	1	7
Maryland	2,397				
Michigan	380	182	364	1	2
Missouri	3,511	53	510	(1)	10
Montana:					
Bituminous	1,317	7	70	(1)	10
Lignite	82				
Total Montana	1,399	7	70	(1)	10
New Mexico	2,023				
North Dakota (lignite)	1,184				
Ohio	22,945	6,608	33,081	1	5
Oklahoma	2,354	43	121	(1)	3
Oregon	8				
Pennsylvania	120,391	11,721	60,563	1	5
South Dakota (lignite)	51				
Tennessee	9,618	2,803	19,408	2	7
Texas:					
Bituminous	54				
Lignite	173				
Total Texas	227				
Utah	3,166	581	1,613	1	3
Virginia	19,416	5,538	32,507	2	6
Washington	2,154				
West Virginia	118,522	4,154	39,997	(1)	10
Wyoming	4,606	68	1,559	(1)	23
Total	461,991	52,305	378,748	1	7

[1] One-half day or less.

BITUMINOUS COAL AND LIGNITE LOADED FOR SHIPMENT BY INDIVIDUAL RAILROADS AND WATERWAYS

TABLE 27.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1942* [1]

Route	State	Quantity	
		By State	Total for route
RAILROADS			
Alabama Central	Alabama	169,039	169,039
Alabama Great Southern	do	177,017	177,017
Alaska	Alaska	242,725	242,725
Algers, Winslow & Western	Indiana	3,182,954	3,182,954
Alton	Illinois	1,410,414	1,415,618
	Missouri	5,204	
Artemus-Jellico	Kentucky	539,604	539,604
Atchison, Topeka & Santa Fe	Colorado	514,311	2,811,592
	Illinois	601,308	
	Kansas	569,040	
	Missouri	6,951	
	New Mexico	1,119,982	

See footnotes at end of table.

TABLE 27.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1942* [1]—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Baltimore & Ohio	Illinois	267, 281	39, 607, 063
	Indiana	720, 717	
	Maryland	68, 113	
	Ohio	4, 216, 368	
	Pennsylvania	12, 373, 029	
	West Virginia	21, 961, 555	
Bessemer & Lake Erie	Pennsylvania	4, 535, 944	4, 535, 944
Bevier & Southern	Missouri	501, 622	501, 622
Brimstone	Tennessee	63, 267	63, 267
Buffalo Creek & Gauley	West Virginia	755, 219	755, 219
Cambria & Indiana	Pennsylvania	5, 408, 316	5, 408, 316
Campbell's Creek	West Virginia	1, 025, 155	1, 025, 155
Carbon County	Utah	437, 153	437, 153
Caseyville	Illinois	31, 371	31, 371
Central of Georgia	Alabama	1, 023, 791	1, 052, 605
	Georgia	28, 814	
Chesapeake & Ohio	Kentucky	10, 279, 239	60, 021, 320
	Ohio	646, 168	
	West Virginia	49, 095, 913	
Cheswick & Harmar	Pennsylvania	974, 362	974, 362
Chicago & Eastern Illinois	Illinois	2, 259, 965	4, 363, 626
	Indiana	2, 103, 661	
Chicago & Illinois Midland	Illinois	4, 905, 749	4, 905, 749
Chicago & North Western	do	3, 016, 510	3, 022, 116
	Wyoming	5, 606	
Chicago, Attica & Southern	Indiana	9, 341	9, 341
Chicago, Burlington & Quincy	Colorado	492, 655	10, 802, 823
	Illinois	8, 955, 698	
	Iowa	358, 650	
	Missouri	59, 172	
	Wyoming	936, 648	
Chicago, Indianapolis & Louisville	Indiana	1, 459, 598	1, 459, 598
Chicago, Milwaukee, St. Paul & Pacific	do	5, 936, 575	7, 357, 572
	Iowa	448, 243	
	Missouri	4, 777	
	Montana (bituminous)	908, 806	
	North Dakota (lignite)	54, 932	
	South Dakota (lignite)		
	Washington	4, 239	
Chicago, Rock Island & Pacific	Arkansas	23, 328	1, 147, 760
	Illinois	633, 438	
	Iowa	180, 770	
	Missouri	231, 880	
	Oklahoma	78, 344	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	5, 310, 138	8, 444, 145
	Indiana	3, 134, 007	
Clinchfield	Kentucky	85, 293	3, 102, 777
	Virginia	3, 017, 484	
Colorado & Southeastern	Colorado	127, 942	127, 942
Colorado & Southern	do	748, 752	748, 752
Colorado & Wyoming	do	627, 947	627, 947
Conemaugh & Black Lick	Pennsylvania	33, 143	33, 143
Cumberland & Pennsylvania	Maryland	600, 771	600, 771
Denver & Intermountain	Colorado	110, 150	110, 150
Denver & Rio Grande Western	do	1, 365, 873	4, 449, 751
	New Mexico	14, 328	
	Utah	3, 069, 550	
Denver & Salt Lake	Colorado	1, 145, 977	1, 145, 977
Des Moines & Central Iowa	Iowa	76, 160	76, 160
Detroit, Toledo & Ironton	Ohio	14, 174	14, 174
East Broad Top Railroad & Coal Co	Pennsylvania	545, 478	545, 478
Erie	Ohio	59, 448	1, 319, 668
	Pennsylvania	1, 260, 220	
Evansville & Ohio Valley	Indiana	7, 518	7, 518
Evansville, Suburban & Newburgh	do	287, 264	287, 264
Fort Dodge, Des Moines & Southern	Iowa	21, 477	21, 477
Fort Smith & Van Buren	Oklahoma	214, 378	214, 378
Fort Smith & Western	do	997	997
Fort Smith, Subiaco & Rock Island	Arkansas	25, 348	25, 348
Galesburg & Great Eastern	Illinois	679, 786	679, 786

See footnotes at end of table.

TABLE 27.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1942* [1]—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Great Northern	Montana (bituminous)	401,335	1,032,581
	Montana (lignite)	476,761	
	North Dakota (lignite)		
	Washington	154,485	
Gulf, Mobile & Ohio	Alabama	303,361	1,489,712
	Illinois	1,186,351	
Harriman & Northeastern	Tennessee	113,675	113,675
Huntingdon & Broad Top Mountain Railroad & Coal Co.	Pennsylvania	329,449	329,449
Illinois Central	Alabama	315,540	19,659,973
	Illinois	12,446,532	
	Indiana	130,640	
	Kentucky	6,767,261	
Illinois Terminal	Illinois	342,477	342,477
Indiana	Indiana	519,777	519,777
International-Great Northern [2]	Texas (lignite)	[2] 286,110	[2] 286,110
Interstate	Kentucky	90,046	2,941,647
	Virginia	2,851,601	
Iowa Southern Utilities Co.	Iowa	134,973	134,973
Johnstown & Stony Creek	Pennsylvania	277,915	277,915
Joplin-Pittsburg	Kansas	362,194	362,194
Kanawha Central	West Virginia	182,542	182,542
Kansas City Southern	Kansas	708,142	763,559
	Oklahoma	55,417	
Kansas, Oklahoma & Gulf	do	20,216	20,216
Kelley's Creek & Northwestern	West Virginia	1,935,981	1,935,981
Kentucky and Tennessee	Kentucky	920,586	920,586
Lake Erie, Franklin & Clarion	Pennsylvania	736,493	736,493
Laramie, North Park & Western	Colorado	5,106	5,106
Ligonier Valley	Pennsylvania	102,046	102,046
Litchfield & Madison	Illinois	725,905	725,905
Louisville & Nashville	Alabama	3,267,961	37,702,822
	Kentucky	32,741,403	
	Tennessee	1,281,664	
	Virginia	411,794	
Mary Lee	Alabama	1,076,896	1,076,896
Midland Valley	Arkansas	613,848	811,919
	Oklahoma	198,071	
Minneapolis & St. Louis	Illinois	1,897,683	2,042,696
	Iowa	145,013	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota (lignite)	662,996	662,996
Missouri-Illinois	Illinois	35,633	35,633
Missouri-Kansas-Texas	Kansas	299,306	653,811
	Missouri	25,039	
	Oklahoma	329,466	
	Texas (lignite)	(2)	
Missouri Pacific	Arkansas	947,930	9,137,797
	Illinois	6,503,051	
	Kansas	1,066,271	
	Missouri	464,297	
	Oklahoma	156,248	
Monessen Southwestern	Pennsylvania	35,804	35,804
Monongahela	do	2,544,147	14,687,389
	West Virginia	12,143,242	
Montana, Wyoming & Southern	Montana (bituminous)	584,400	584,400
Montour	Pennsylvania	6,137,959	6,137,959
Moorehead & North Fork	Kentucky	1,643	1,643
Nashville, Chattanooga & St. Louis	Alabama	4,414	1,095,255
	Tennessee	1,090,841	
New York Central (includes coal shipped over Kanawha & Michigan, Kelley's Creek, Toledo & Ohio Central, and Zanesville & Western).	Ohio	6,440,806	12,502,992
	Pennsylvania	5,073,508	
	West Virginia	988,678	
Nicholas, Fayette & Greenbrier	do	2,570,345	2,570,345
Norfolk & Western	Kentucky	5,518,775	52,537,476
	Virginia	11,007,746	
	West Virginia	36,010,955	
Northern Alabama	Alabama	123,498	123,498
Northern Pacific	Montana (bituminous)	1,705,160	3,378,188
	North Dakota (lignite)	716,413	
	Washington	956,615	
Oneida & Western	Tennessee	18,289	18,289
Pacific Coast	Washington	160,696	160,696

See footnotes at end of table.

TABLE 27.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1942*[1]—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago & St. Louis).	Illinois	201, 113	52, 699, 144
	Indiana	2, 991, 643	
	Ohio	6, 309, 496	
	Pennsylvania	42, 072, 069	
	West Virginia	1, 124, 823	
Peoria Terminal	Illinois	351, 712	351, 712
Pere Marquette	Michigan	69, 930	69, 930
Pittsburg & Shawmut	Pennsylvania	1, 884, 383	1, 884, 383
Pittsburg County	Oklahoma	18, 712	18, 712
Pittsburgh & Lake Erie	Pennsylvania	3, 801, 787	3, 801, 787
Pittsburgh & West Virginia	Ohio	999, 498	2, 147, 729
	Pennsylvania	858, 879	
	West Virginia	289, 352	
Pittsburgh, Chartiers & Youghiogheny	Pennsylvania	6, 784	6, 784
Pittsburgh, Lisbon & Western	Ohio	12, 645	12, 760
	Pennsylvania	115	
Pittsburg, Shawmut & Northern	do	595, 891	595, 891
Preston	West Virginia	160, 699	160, 699
Rio Grande Southern	Colorado	8, 796	8, 796
Rockdale, Sandow & Southern	Texas (lignite)	(2)	(2)
St. Louis & Hannibal	Missouri	437	437
St. Louis & O'Fallon	Illinois	354, 517	354, 517
St. Louis-San Francisco	Alabama	1, 876, 314	4, 456, 512
	Arkansas	257, 353	
	Kansas	831, 651	
	Missouri	377, 823	
	Oklahoma	1, 113, 371	
St. Louis Southwestern of Texas	Texas (lignite)	(2)	(2)
Seaboard Air Line	Alabama	88, 099	88, 099
Southern	do	3, 033, 237	10, 914, 306
	Illinois	6, 442	
	Indiana	1, 689, 560	
	Kentucky	1, 518, 942	
	Tennessee	3, 109, 261	
	Virginia	1, 556, 864	
Southern Pacific	New Mexico	373, 575	373, 575
Springfield Terminal	Illinois	688, 566	688, 566
Tennessee	Tennessee	1, 190, 307	1, 190, 307
Tennessee Central	do	485, 396	485, 396
Tennessee Coal, Iron & Railroad Co	Alabama	3, 641, 709	3, 641, 709
Texas & Pacific	Texas (bituminous)	9, 053	9, 053
Texas Short Line	Texas (lignite)	(2)	(2)
Thomas & Sayreton	Alabama	889, 249	889, 249
Toledo, Peoria & Western	Illinois	93, 467	93, 467
Union	Pennsylvania	107, 995	107, 995
Union Pacific	Colorado	871, 155	7, 808, 834
	Utah	23, 182	
	Washington	58, 801	
	Wyoming	6, 855, 696	
Unity	Pennsylvania	694, 555	694, 555
Utah	Utah	1, 455, 209	1, 455, 209
Virginian	Virginia	184, 468	13, 323, 594
	West Virginia	13, 139, 126	
Wabash	Illinois	2, 545, 473	3, 026, 913
	Iowa	14, 895	
	Missouri	466, 545	
Western Allegheny	Pennsylvania	106, 349	106, 349
Western Maryland	Maryland	963, 512	6, 046, 738
	Pennsylvania	522, 605	
	West Virginia	4, 560, 621	
West Virginia Northern	do	454, 650	454, 650
Wheeling & Lake Erie	Ohio	6, 075, 722	6, 075, 722
Winifrede	West Virginia	208, 404	208, 404
Woodward Iron Co	Alabama	1, 091, 029	1, 091, 029
Youngstown & Suburban	Ohio	24, 975	24, 975
Total railroad shipments		482, 814, 042	482, 814, 042

See footnotes at end of table.

TABLE 27.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in net tons, in 1942* [1]—Continued

Route	State	Quantity	
		By State	Total for route
WATERWAYS			
Allegheny River	Pennsylvania	1,122,106	1,122,106
Black Warrior River	Alabama	415,186	415,186
Cheat River	Pennsylvania	137,234	137,234
Green River	Kentucky	617	617
Illinois River	Illinois	553,228	553,228
Kanawha River	West Virginia	2,328,631	2,328,631
Monongahela River	Pennsylvania	26,912,826	27,713,681
	West Virginia	800,855	
Muskingum River	Ohio	1,057,672	1,057,672
Ohio River	Kentucky	201,209	579,847
	Ohio	2,784	
	West Virginia	375,854	
Tennessee River	Tennessee	109,823	109,823
Total waterway shipments		34,018,025	34,018,025
Total loaded at mines for shipment by railroads and waterways.		516,832,067	516,832,067
Shipped by truck or wagon		45,154,432	45,154,432
Taken by locomotive tenders at tipple		920,213	920,213
Shipped by conveyor or tram to point of consumption.		7,121,116	7,121,116
Coal used by employees		2,180,077	2,180,077
Used at mine for power and heat		2,708,312	2,708,312
Made into beehive coke at mine		7,776,720	7,776,720
Total production		582,692,937	582,692,937

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[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding for shipment by rail, and hauled by truck to waterway for shipment by water. In general, the figures show the quantity of bituminous coal and lignite originated for each railroad and waterway as reported by the mine operators. It must be noted that in 1 year an operator may report coal loaded on the subsidiary railroad and in another year the same operator may report coal loaded on the parent railroad system.

[2] Texas lignite mines shipping over the Missouri-Kansas-Texas, Rockdale, Sandow & Southern, St. Louis Southwestern of Texas, and the Texas Short Line have been included with the International-Great Northern

METHODS OF RECOVERY

Table 28.—*Bituminous coal and lignite mined by different methods in the United States, by States, in 1942*

State	From underground workings							From strip pits		Grand total production (net tons)
	Mined by hand		Shot off the solid		Cut by machines		Total underground (net tons)	Net tons	Percent of grand total	
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground				
Alabama	416,851	2.2	3,632,213	19.1	14,952,207	78.7	19,001,271	299,983	1.6	19,301,254
Alaska			260,893	100.0			260,893			260,893
Arizona			11,373	100.0			11,373			11,373
Arkansas	3,356	.2	178,900	9.9	1,620,302	89.9	1,802,558	182,835	9.2	1,985,393
Colorado	1,778,969	22.0	230,692	2.9	6,069,264	75.1	8,078,925	6,755	.1	8,085,680
Georgia			30,913	100.0			30,913			30,913
Illinois	245,517	.5	2,866,728	5.8	46,123,226	93.7	49,235,471	15,835,348	24.3	65,070,819
Indiana	48,738	.4	491,112	4.5	10,372,541	95.1	10,912,391	14,475,660	57.0	25,388,051
Iowa	230,547	10.3	913,213	40.7	1,099,200	49.0	2,242,960	704,762	23.9	2,947,722
Kansas	50,095	8.2	254,734	41.6	307,216	50.2	612,045	3,617,813	85.5	4,229,858
Kentucky	1,463,199	2.4	2,709,569	4.5	56,621,838	93.1	60,794,606	1,436,160	2.3	62,230,766
Maryland	1,057,496	53.5			919,973	46.5	1,977,469	23,465	1.2	2,000,934
Michigan					231,148	100.0	231,148			231,148
Missouri	151,353	12.8	109,818	9.3	918,352	77.9	1,179,523	2,340,354	66.5	3,519,877
Montana (bituminous)	1,663	.1	23,521	1.1	2,047,611	98.8	2,072,795	1,706,749	45.2	3,779,544
Montana and Texas (lignite)	18,807	7.4	229,737	90.7	4,846	1.9	253,390	86,717	25.5	340,107
New Mexico	524,513	31.4	267,284	16.0	876,862	52.6	1,668,659			1,668,659
North Dakota (lignite)	5,066	.6	147,387	17.9	669,074	81.5	821,527	1,715,489	67.6	2,537,016
Ohio	180,158	.8	152,143	.6	23,107,526	98.6	23,439,827	9,324,641	28.5	32,764,468
Oklahoma	5,347	.4	154,082	12.0	1,126,110	87.6	1,285,539	1,101,653	46.1	2,387,192
Oregon	1,090	51.0	1,047	49.0			2,137			2,137
Pennsylvania	17,565,609	13.3	3,610,313	2.7	111,440,738	84.0	132,616,660	11,456,529.	8.0	144,073,189
South Dakota (lignite)	(1)		[1] 4,362	100.0			4,362	49,176	91.9	53,538
Tennessee	693,395	8.5	1,203,194	14.7	6,261,648	76.8	8,158,237			8,158,237
Texas (bituminous)	13,210	100.0					13,210			13,210
Utah	12,945	.2	97,672	1.8	5,406,232	98.0	5,516,849			5,516,849
Virginia	134,394	.7	1,670,844	8.3	18,330,941	91.0	20,136,179			20,136,179
Washington	224,971	11.7	680,487	35.6	1,008,240	52.7	1,913,698	39,511	2.0	1,953,209
West Virginia	6,991,576	4.5	1,184,156	.8	145,092,671	94.7	153,268,403	2,613,094	1.7	155,881,497
Wyoming	23,012	.3	187,291	2.4	7,736,953	97.3	7,947,256	185,969	2.3	8,133,225
Total	31,841,877	6.2	21,303,678	4.1	462,344,719	89.7	515,490,274	67,202,663	11.5	582,692,937

[1] Some coal "mined by hand" included under "shot off the solid."

Minimum price area and producing district	From underground workings							From strip pits		Grand total production (net tons)
	Mined by hand		Shot off the solid		Cut by machines		Total underground (net tons)			
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground		Net tons	Percent of grand total	
PRICE AREA 1										
Dist. 1. Eastern Pennsylvania [1]	12,405,718	23.2	1,350,519	2.5	39,728,041	74.3	53,484,278	4,679,531	8.0	58,163,809
Dist. 2. Western Pennsylvania	6,507,774	7.9	2,293,349	2.8	73,251,488	89.3	82,052,611	6,800,463	7.7	88,853,074
Dist. 3 Northern West Virginia	2,200,457	5.9	502,221	1.3	34,582,236	92.8	37,284,914	1,598,132	4.1	38,883,046
Dist. 4. Ohio	180,158	.8	152,143	.6	23,107,526	98.6	23,439,827	9,324,641	28.5	32,764,468
Dist. 5. Michigan					231,148	100.0	231,148			231,148
Dist. 6. Panhandle	15,954	.3			4,610,376	99.7	4,626,330	878,665	16.0	5,504,995
Dist. 7. Southern numbered 1	3,973,257	6.2	653,888	1.0	59,832,854	92.8	64,459,999	136,297	.2	64,596,296
Dist. 8. Southern numbered 2	2,609,888	2.1	4,106,747	3.4	114,655,688	94.5	121,372,323	136,904	.1	121,509,227
Total, price area 1	27,893,206	7.2	9,058,867	2.3	349,999,357	90.5	386,951,430	23,554,633	5.7	410,506,063
PRICE AREA 2										
Dist. 9. Western Kentucky	162,775	1.3	616,805	5.1	11,352,188	93.6	12,131,768	1,299,256	9.7	13,431,024
Dist. 10. Illinois	245,517	.5	2,866,728	5.8	46,123,226	93.7	49,235,471	15,835,348	24.3	65,070,819
Dist. 11. Indiana	48,738	.4	491,112	4.5	10,372,541	95.1	10,912,391	14,475,660	57.0	25,388,051
Dist. 12. Iowa	230,547	10.3	913,213	40.7	1,099,200	49.0	2,242,960	704,762	23.9	2,947,722
Total, price area 2	687,577	.9	4,887,858	6.6	68,947,155	92.5	74,522,590	32,315,026	30.2	106,837,616
PRICE AREA 3										
Dist. 13. Southeastern	446,697	2.2	4,517,673	21.9	15,607,145	75.9	20,571,515	299,983	1.4	20,871,498
PRICE AREA 4										
Dist. 14. Arkansas-Oklahoma	3,356	.2	253,925	11.2	2,007,371	88.6	2,264,652	235,939	9.4	2,500,591
PRICE AREA 5										
Dist. 15. Southwestern:										
Bituminous	220,005	8.4	443,609	16.9	1,964,609	74.7	2,628,223	7,006,716	72.7	9,634,939
Lignite (Texas) [2]	18,807	7.4	229,737	90.7	4,846	1.9	253,390	86,717	25.5	340,107
Total, price area 5 [3]	238,812	8.3	673,346	23.4	1,969,455	68.3	2,881,613	7,093,433	71.1	9,975,046

See footnotes at end of table.

TABLE 29.—*Bituminous coal and lignite mined by different methods in the United States, by districts, in 1942*—Continued

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	From underground workings							From strip pits		Grand total production (net tons)
	Mined by hand		Shot off the solid		Cut by machines		Total underground (net tons)			
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground		Net tons	Percent of grand total	
PRICE AREA 6										
Dist. 16. Northern Colorado	67,081	2.5	69,857	2.6	2,564,223	94.9	2,701,161	6,755	0.2	2,707,916
Dist. 17. Southern Colorado [3]	1,867,484	29.7	160,835	2.5	4,267,737	67.8	6,296,056			6,296,056
Dist. 18. New Mexico [4]	368,917	48.4	278,657	36.6	114,166	15.0	761,740			761,740
Total, price area 6	2,303,482	23.6	509,349	5.2	6,946,126	71.2	9,758,957	6,755	.1	9,765,712
PRICE AREA 7										
Dist. 19. Wyoming [5]	23,012	.3	187,291	2.4	7,736,953	97.3	7,947,256	185,969	2.3	8,133,225
Dist. 20. Utah	12,945	.2	97,672	1.8	5,406,232	98.0	5,516,849			5,516,849
Total, price area 7	35,957	.3	284,963	2.1	13,143,185	97.6	13,464,105	185,969	1.4	13,650,074
PRICE AREA 8										
Dist. 21. North-South Dakota (lignite)	[6] 5,066	.6	[6] 151,749	18.4	669,074	81.0	825,889	1,764,665	68.1	2,590,554
PRICE AREA 9										
Dist. 22. Montana [2]	1,663	.1	23,521	1.1	2,047,611	98.8	2,072,795	1,706,749	45.2	3,779,544
PRICE AREA 10										
Dist. 23. Washington [7]	226,061	11.8	681,534	35.6	1,008,240	52.6	1,915,835	39,511	2.0	1,955,346
Alaska			260,893	100.0			260,893			260,893
Total, price area 10	226,061	10.4	942,427	43.3	1,008,240	46.3	2,176,728	39,511	1.8	2,216,239
Grand total [8]	31,841,877	6.2	21,303,678	4.1	462,344,719	89.7	515,490,274	67,202,663	11.5	582,992,937

[1] Includes Maryland, and Grant, Mineral, and Tucker Counties, W. Va.

[2] For purposes of concealment of individual operators' figures, Montana lignite, with production of 49,138 tons, has been included with Texas lignite.

[3] Includes Colfax County, N. Mex.

[4] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[5] Includes Idaho. No production was reported for Idaho.

[6] Some coal "Mined by hand" in South Dakota included under "Shot off the solid."

[7] Includes Oregon.

[8] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

TABLE 30.—*Number of coal-cutting machines in bituminous-coal and lignite mines, average output per machine, and percent of total product of underground mines cut by machines in the United States, by States, in 1942*

State	Number of coal-cutting machines in use			Average output per machine (net tons)	Percent of total product of underground mines cut by machines
	Permissible	Other	Total		
Alabama	229	396	625	23,924	78.7
Arkansas	70	47	117	13,849	89.9
Colorado	219	266	485	12,514	75.1
Illinois	239	646	885	52,117	93.7
Indiana	97	176	273	37,995	95.1
Iowa	50	60	110	9,993	49.0
Kansas	30	10	40	7,680	50.2
Kentucky	445	1,183	1,628	34,780	93.1
Maryland	17	31	48	19,166	46.5
Michigan	9	15	24	9,631	100.0
Missouri	53	38	91	10,092	77.9
Montana:					
Bituminous	21	51	72	28,439	98.8
Lignite	(1)	(1)	(1)	(1)	(1)
New Mexico	24	37	61	14,375	52.6
North Dakota (lignite)	[1] 16	[1] 9	[1] 25	[1] 26,957	[1] 77.9
Ohio	294	619	913	25,309	98.6
Oklahoma	51	56	107	10,524	87.6
Pennsylvania	2,133	1,168	3,301	33,760	84.0
Tennessee	27	200	227	27,584	76.8
Utah	97	52	149	36,283	98.0
Virginia	111	250	361	50,778	91.0
Washington	57	1	58	17,383	52.7
West Virginia	937	2,196	3,133	46,311	94.7
Wyoming	37	279	316	24,484	97.3
Total	5,263	7,786	13,049	35,431	89.7

[1] Montana lignite included with North Dakota.

STRIPPING OPERATIONS

TABLE 31.—*Stripping operations of all types in the butuminous-coal and lignite fields of the United States, by States and Counties, in 1942*

[Returns for mines that recover coal both by stripping and by underground operations do not permit separating men engaged in stripping from those engaged in other work. For this reason, the figures of men employed represent all persons working at these mines, including those underground. The total tons produced by both methods at these mines are also shown]

State and county	Number of strip pits	Number of power shovels			Coal produced (net tons)		Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	All others	Mined by stripping	Total at same mines	Underground	Surface: In strip pits	Surface: All others	Total			
Alabama:													
Blount and Jefferson	4	4		2	46,496	61,505	23	52	18	93	254	23,664	2.60
Marion	1				2,863	2,863		4		4	157	628	4.56
Walker	4	7		2	250,624	282,519	30	139	58	227	254	57,693	4.90
Total Alabama	9	11		4	299,983	346,887	53	195	76	324	253	81,985	4.23
Arkansas:													
Franklin and Johnson	6	1		5	80,585	80,585		54	22	76	127	9,639	8.36
Sebastian	4			2	102,250	102,753	3	49	13	65	186	12,112	8.48
Total Arkansas	10	1		7	182,835	183,338	3	103	35	141	154	21,751	8.43
Illinois:													
Bureau, Grundy, Henry, Knox, Saline, Schuyler, Vermilion, and Will	12		22	20	4,125,513	4,125,513		667	482	1,149	270	309,892	13.31
Fulton	11		24	12	5,838,635	5,838,635		433	611	1,044	242	252,951	23.08
Hancock	1			2	15,632	15,632		10	11	21	74	1,560	10.02
Jackson	1		3		515,980	1,017,968	105	69	81	255	269	68,707	14.82
La Salle	5		2	6	172,453	172,453		57	36	93	174	16,164	10.67
Livingston	1				1,013	1,013		4	1	5	50	250	4.05
McDonough	2			1	5,438	5,438		7		7	155	1,088	5.00
Perry	3		13	3	3,008,289	3,008,289		330	365	695	267	185,860	16.19
Randolph	1		1	1	906,471	906,471		51	54	105	258	27,090	33.46
St. Clair	3		5	8	1,055,130	1,055,130		107	63	170	276	46,862	22.52
Williamson	3	1		4	190,794	190,794		39	26	65	165	10,694	17.84
Total Illinois	43	1	70	57	15,835,348	16,337,336	105	1,774	1,730	3,609	255	921,118	17.74

Indiana:													
Clay	22	3	14	33	2,030,722	2,030,722		412	282	694	235	162,802	12.47
Daviess, Knox, and Spencer	5			13	372,243	372,243		77	57	134	219	29,394	12.66
Dubois	1			1	1,755	1,755		3		3	88	264	6.65
Fountain	4			5	84,413	84,413		28	12	40	174	6,974	12.10
Greene	11	6	10	7	2,143,883	2,143,883		368	269	637	259	164,730	13.01
Owen	1			2	43,319	43,319		18	16	34	100	3,390	12.78
Pike	11	2	19	6	4,394,472	4,394,472		468	457	925	249	230,591	19.06
Sullivan	7	3	1	7	737,567	737,567		155	118	273	228	62,218	11.85
Vermillion	4		3	3	364,393	364,393		80	109	189	145	27,457	13.27
Vigo	7		4	10	1,319,416	1,319,416		196	156	352	250	87,941	15.00
Warrick	5		9	10	2,983,477	2,983,477		228	312	540	301	162,650	18.34
Total Indiana	78	14	60	97	14,475,660	14,475,660		2,033	1,788	3,821	246	938,411	15.43
Iowa:													
Boone	1			1	3,722	3,722		4		4	260	1,038	3.59
Davis, Jasper, Keokuk, and Monroe	4	1		3	25,892	25,892		23	4	27	240	6,472	4.00
Mahaska	12			18	299,513	299,513		108	58	166	168	27,828	10.76
Marion	12		1	20	277,524	277,524		102	33	135	207	27,943	9.93
Van Buren	4			4	24,010	24,010		21	8	29	226	6,558	3.66
Wapello	5			9	74,101	74,101		36	13	49	193	9,469	7.83
Total Iowa	38	1	1	55	704,762	704,762		294	116	410	193	79,308	8.89
Kansas:													
Bourbon	4	3	2	1	208,593	208,593		47	20	67	227	15,210	13.71
Cherokee	8	2	9	3	1,237,067	1,237,067		142	178	320	259	83,007	14.90
Crawford	18	15	11	3	1,444,335	1,444,335		340	150	490	212	103,948	13.89
Labette and Wilson	4	3		1	14,765	14,765		19	3	22	182	4,000	3.69
Linn	3	2	2	1	712,002	712,002		59	70	129	260	33,508	21.25
Osage	1	2			1,051	1,051		3	1	4	56	224	4.69
Total Kansas	38	27	24	9	3,617,813	3,617,813		610	422	1,032	232	239,897	15.08
Kentucky:													
Christian, Muhlenberg, and Ohio	4	5		3	70,606	70,606		52	21	73	95	6,962	10.14
Hopkins	4	1	4	5	1,228,650	1,228,650		114	88	202	266	53,687	22.89
Laurel and Whitley	3	1		3	136,904	136,904		49	24	73	181	13,231	10.35
Total Kentucky	11	7	4	11	1,436,160	1,436,160		215	133	348	212	73,880	19.44
Maryland: Allegany	3			4	23,465	23,465		16	6	22	151	3,332	7.04
Missouri:													
Barton	4	2	2	2	226,581	226,581		49	24	73	223	16,256	13.94
Bates	6	2	2	3	125,831	125,831		79	55	134	97	12,950	9.72
Boone	3	2		3	30,749	30,749		26	6	32	220	7,037	4.37
Callaway	4	2		5	191,069	191,069		70	11	81	295	23,909	7.99
Carroll	1			1	1,238	1,238		5		5	148	740	1.67

Table 31.—*Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and Counties, in 1942*—Con.

State and county	Number of strip pits	Number of power shovels			Coal produced (net tons)		Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	All others	Mined by stripping	Total at same mines	Under-ground	Surface		Total			
								In strip pits	All others				
Missouri—Continued.													
Clark, Monroe, Ralls, Randolph, and St. Clair	6	4	2	4	467, 807	467, 807		74	56	130	259	33, 728	13. 87
Dade	3			4	13, 339	13, 339		14	3	17	231	3, 920	3. 40
Henry	8	6	2	1	451, 526	451, 526		95	45	140	263	36, 826	12. 26
Jasper	1	1			10, 399	10, 399		7	2	9	294	2, 646	3. 93
Johnson	3		4	1	218, 468	218, 468		66	15	81	221	17, 890	12. 21
Lincoln	1			1	1, 016	1. 016		2		2	64	128	7. 94
Macon	1		4	1	507, 772	507, 772		70	49	119	261	31, 078	16. 34
Vernon	7	7	1	1	94, 539	94, 539		78	13	91	164	14, 906	6. 34
Total Missouri	48	26	17	27	2, 340, 354	2, 340, 354		635	279	914	221	202, 014	11. 59
Montana (bituminous): Rosebud	1		5		1, 706, 749	1, 706, 749		72	19	91	300	27, 304	62. 51
Montana and Texas: Lignite	5	2	2	4	86, 717	86, 717		46	2	48	102	4, 875	17. 79
North Dakota: Lignite	63	8	9	32	1, 715, 489	1, 723, 013	13	386	161	560	202	113, 306	15. 21
Ohio:													
Athens	1			3	48, 000	48, 000		20	5	25	210	5, 250	9. 14
Belmont	5			13	334, 100	334, 100		116	69	185	152	28, 176	11. 86
Carroll	8	1		21	287, 729	296, 016	7	105	37	149	203	30, 229	9. 79
Columbiana	18	2		32	806, 372	806, 372		194	65	259	237	61, 262	13. 16
Coshocton	3	1		3	30, 585	61, 638	16	23	10	49	256	12, 550	4. 91
Gallia	1			1	7, 457	7, 457		10	3	13	72	936	7. 97
Guernsey	2			2	25, 026	25, 026		19	6	25	184	4, 600	5. 44
Harrison	16		4	34	2, 954, 642	3, 065, 865	238	479	305	1, 022	169	172, 598	17. 76
Hocking, Holmes, and Wayne	5	1		4	52, 495	55, 731	7	17	7	31	261	8, 104	6. 88
Jackson	6			5	25, 892	27, 914	7	33	8	48	139	6, 693	4. 17
Jefferson	10	2	4	21	2, 360, 004	2, 360, 004		334	231	565	246	138, 720	17. 01
Mahoning	8	6	2	13	309, 883	309, 883		105	15	120	279	33, 494	9. 25
Muskingum	4	2		6	74, 836	74, 836		54	17	71	97	6, 889	10. 86
Perry	6		1	10	309, 675	311, 812	7	53	32	92	237	21, 798	14. 30
Portage	1			4	71, 605	71, 605		12	7	19	317	6, 020	11. 89
Stark	17			24	503, 935	503, 935		192	54	246	204	50, 182	10. 04
Tuscarawas	22	6	2	37	1, 044, 675	1, 044, 675		343	92	435	242	105, 292	9. 92
Vinton	8	2		4	77, 730	77, 730		60	10	70	242	16, 960	4. 58
Total Ohio	141	23	13	237	9, 324, 641	9, 482, 599	282	2, 169	973	3, 424	207	709, 753	13. 36

Oklahoma:													
Craig, Haskell, Muskogee, Sequoyah, and Wagoner	8	6	3	6	768, 175	768, 175	....	171	99	270	225	60, 825	12. 63
McIntosh	1	....	....	....	1, 573	1, 573	....	2	....	2	180	360	4. 37
Rogers	3	4	3	1	331, 905	331, 905	....	94	59	153	242	36, 964	8. 98
Total Oklahoma	12	10	6	7	1, 101, 653	1, 101, 653	....	267	158	425	231	98, 149	11. 22
Pennsylvania:													
Allegheny	35	10	....	47	1, 264, 259	1, 352, 120	135	339	190	664	166	110, 448	12. 24
Armstrong	12	2	....	15	573, 456	875, 920	253	159	122	534	199	106, 343	8. 24
Beaver	9	....	....	21	426, 850	426, 850	....	110	62	172	194	33, 298	12. 82
Butler	15	5	....	21	393, 730	476, 137	78	172	75	325	170	55, 344	8. 60
Cambria	6	....	....	7	114, 002	135, 943	20	71	35	126	97	12, 214	11. 13
Cameron, Elk, Fulton, Tioga, and Venango	10	1	....	11	239, 872	572, 655	297	45	84	426	249	106, 076	5. 40
Center	4	3	....	7	174, 810	432, 692	223	57	30	310	240	74, 286	5. 82
Clarion	19	3	....	43	1, 919, 246	1, 924, 595	3	411	129	543	206	111, 613	17. 24
Clearfield	38	11	1	41	908, 053	1, 240, 893	341	331	172	844	213	179, 917	6. 90
Clinton	2	....	....	5	206, 649	206, 649	....	81	28	109	256	27, 933	7. 40
Fayette	28	4	....	34	972, 879	1, 452, 746	193	281	159	633	184	116, 661	12. 45
Jefferson	7	....	....	12	313, 182	485, 603	141	94	52	287	221	63, 439	7. 65
Lawrence	7	....	....	11	119, 986	151, 611	33	43	12	88	205	18, 055	8. 40
Lycoming	1	1	....	....	1, 885	2, 132	2	2	1	5	74	370	5. 76
McKean	2	1	....	....	4, 351	4, 351	....	4	3	7	195	1, 366	3. 19
Mercer	3	....	....	8	293, 579	293, 579	....	47	33	80	249	19, 943	14. 72
Somerset	6	1	....	12	221, 693	221, 693	....	56	33	89	176	15, 657	14. 16
Washington	22	4	2	39	1, 856, 825	2, 153, 993	226	442	225	893	202	179, 958	11. 97
Westmoreland	38	10	1	46	1, 451, 222	2, 459, 288	634	464	236	1, 334	215	287, 433	8. 56
Total Pennsylvania	264	56	4	380	11, 456, 529	14, 869, 450	2, 579	3, 209	1, 681	7, 469	204	1, 520. 354	9. 78
South Dakota: Lignite	6	....	....	6	49, 176	49, 176	....	33	4	37	227	8, 384	5. 87
West Virginia:													
Barbour, Fayette, Hancock, Randolph, and Taylor	7	1	....	11	249, 117	249, 117	....	76	38	114	154	17, 564	14. 18
Brooke	10	....	2	17	722, 250	1, 676, 838	459	151	111	721	231	166, 312	10. 08
Greenbrier	3	2	....	1	15, 357	53, 655	24	20	6	50	170	8. 505	6. 31
Harrison	22	2	....	30	878, 681	2, 351, 876	715	244	239	1, 198	217	259, 741	9. 05
Marion	5	....	....	7	136, 669	136, 669	....	91	23	114	65	7, 416	18. 43
Marshall	1	1	....	....	16, 200	16, 200	....	12	....	12	95	1, 140	14. 21
Monongalia	3	....	....	5	133, 509	690, 633	201	35	58	294	289	85, 086	8. 12
Preston	4	3	....	8	342, 029	342, 029	....	101	44	145	246	35, 609	9. 61
Raleigh	2	....	....	2	119, 282	119, 282	....	38	22	60	168	10, 108	11. 80
Total West Virginia	57	9	2	81	2, 613, 094	5, 636, 299	1, 399	768	541	2, 708	218	591, 481	9. 53

TABLE 31.—*Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and Counties, in 1942*—Con.

State and county	Number of strip pits	Number of power shovels			Coal produced (net tons)		Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	All others	Mined by stripping	Total at same mines	Under-ground	Surface		Total			
								In strip pits	All others				
Wyoming:													
Campbell	1		2		121,435	121,435		18	12	30	263	7,902	15.37
Carbon and Converse	3	3			63,488	63,488		34	1	35	210	7,336	8.65
Sheridan	1				1,046	1,046		2		2	134	268	3.90
Total Wyoming	5	3	2		185,969	185,969		54	13	67	231	15,506	11.99
Other States [1]	2			2	46,266	138,878	79	14	17	110	295	32,395	4.29
Total United States	834	199	219	1,020	67,202,663	74,446,278	4,513	12,893	8,154	25,560	222	5,683,203	13.10

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[1] Includes Colorado and Washington.

TABLE 32.—*Summary of operations of power strip pits proper in the bituminous-coal and lignite fields of the United States, by States, in 1942*

State	Number of strip pits	Number of power shovels			Amount mined by stripping[1] (net tons)	Number of men employed	Average number of days mines were active	Average tons per man per day
		Steam	Electric	All others				
Power strip pits proper:								
Alabama	5	9		2	247,657	187	289	4.58
Arkansas	6	1		7	173,688	122	155	9.21
Illinois	40	1	67	57	15,317,133	3,345	255	17.98
Indiana	71	14	60	97	14,464,988	3,806	246	15.45
Iowa	36	1	1	55	699,685	401	195	8.95
Kansas	35	27	24	9	3,613,527	1,021	233	15.20
Kentucky	11	7	4	11	1,436,160	348	212	19.44
Maryland	3			4	23,465	22	151	7.04
Missouri	44	26	17	27	2,330,426	898	221	11.75
Montana (bituminous)	1		5		1,706,749	91	300	62.51
Montana and Texas (lignite)	5	2	2	4	86,717	48	102	17.79
North Dakota (lignite)	31	8	7	32	1,412,679	447	219	14.43
Ohio	129	22	13	224	9,083,912	3,001	211	14.33
Oklahoma	11	10	6	7	1,100,080	423	231	11.25
Pennsylvania	202	36	2	318	9,274,946	3,676	166	15.19
South Dakota (lignite)	4			6	48,226	34	238	5.96
West Virginia	45	6		68	2,223,791	884	156	16.13
Other States[2]	3	3	2	1	179,811	66	237	11.48
Total	682	173	210	929	63,423,640	18,820	217	15.52
Horse stripping operations	71				98,833	215	117	3.94
Mines combining stripping and underground methods in the same operations[3]	81	26	9	91	3,680,190	[4] 6,525	[4] 241	[4] 6.95
Grand total	834	199	219	1,020	67,202,663	[4] 25,560	[4] 222	[4] 13.10

[1] Excludes coal produced by underground mining conducted in the same operation.

[2] Includes Colorado and Wyoming.

[3] Includes operations in Alabama, Arkansas, Illinois, North Dakota (lignite), Ohio, Pennsylvania, Washington, and West Virginia in which the output was obtained by both methods. In addition to the 3,680,190 tons produced by stripping, this group of 81 mines obtained 7,243,615 tons by underground methods, their total production by both methods being 10,923,805 tons.

[4] Includes data on underground mining conducted in the same operation.

TABLE 33.—*Summary of operations of power strip pits proper in the bituminous-coal and lignite fields of the United States, by districts, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	Number of strip pits	Number of power shovels			Amount mined by stripping[1] (net tons)	Number of men employed	Average number of days mines were active	Average tons per man per day
		Steam	Electric	All others				
PRICE AREA 1								
Dist. 1. Eastern Pennsylvania[2]	76	12		131	3,727,714	1,537	171	14.15
Dist. 2. Western Pennsylvania	129	24	2	191	5,570,697	2,161	162	15.90
Dist. 3. Northern West Virginia	28	3		41	1,338,864	560	145	16.45
Dist. 4. Ohio	129	22	13	224	9,083,912	3,001	211	14.33
Dist. 5. Michigan								
Dist. 6. Panhandle	12	1		23	750,086	230	192	17.02
Dist. 7. Southern numbered 1	5	2		4	134,841	94	132	10.88
Dist. 8. Southern numbered 2	3	1		3	136,904	73	181	10.35
Total, price area 1	382	65	15	617	20,743.018	7,656	183	14.83
PRICE AREA 2								
Dist. 9. Western Kentucky	8	6	4	8	1,299,256	275	221	21 42
Dist. 10. Illinois	40	1	67	57	15,317,133	3,345	255	17.98
Dist. 11. Indiana	71	14	60	97	14,464,988	3,806	246	15.45
Dist. 12. Iowa	36	1	1	55	699,685	401	195	8.95
Total, price area 2	155	22	132	217	31,781,062	7,827	246	16.50

See footnotes at end of table.

TABLE 33.—*Summary of operations of power strip pits proper in the bituminous-coal and lignite fields of the United States, by districts, in 1943*—Continued

Minimum price area and producing district	Number of strip pits	Number of power shovels			Amount mined by stripping (net tons)	Number of men employed	Average number of days mines were active	Average tons per man per day
		Steam	Electric	All others				
PRICE AREA 3								
Dist. 13. Southeastern	5	9	......	2	247,657	187	289	4.58
PRICE AREA 4								
Dist. 14. Arkansas-Oklahoma	8	2	......	10	(3)	(3)	(3)	(3)
PRICE AREA 5								
Dist. 15. Southwestern:								
Bituminous	88	62	47	40	6,990,929	2,290	229	13.32
Lignite (Texas) [4]	5	2	2	4	86,717	48	102	17.79
Total price area 5	93	64	49	44	7,077,646	2,338	227	13.36
PRICE AREA 6								
Dist. 16. Northern Colorado	1	......	......	1	(3)	(3)	(3)	(3)
Dist. 17. Southern Colorado [5]	......	......	......	......	......	......	......	......
Dist. 18. New Mexico [6]	......	......	......	......	......	......	......	......
Total, price area 6	1	......	......	1	(3)	(3)	(3)	(3)
PRICE AREA 7								
Dist. 19. Wyoming [7]	2	3	2	......	(3)	(3)	(3)	(3)
Dist. 20. Utah	......	......	......	......	......	......	......	......
Total price area 7	2	3	2	......	(3)	(3)	(3)	(3)
PRICE AREA 8								
Dist. 21. North-South Dakota (lignite)	35	8	7	38	1,460,905	481	220	13.78
PRICE AREA 9								
Dist. 22. Montana (bituminous) [4]	1	......	5	......	1,706,749	91	300	62.51
PRICE AREA 10								
Dist. 23. Washington [8]	......	......	......	......	......	......	......	......
Alaska	......	......	......	......	......	......	......	......
Total, price area 10	......	......	......	......	......	......	......	......
Undistributed	......	......	......	......	406,603	240	180	9.39
Total	682	173	210	929	63,423,640	18,820	217	15.52
Horse stripping operations	71	......	......	......	98,833	215	117	3.94
Mines combining stripping and underground methods in the same operations [9]	81	26	9	91	3,680,190	[10] 6,525	[10] 241	[10] 6.96
Grand total [11]	834	199	219	1,020	67,202,663	[10] 25,560	[10] 222	[10] 13.10

[1] Excludes coal produced by underground mining conducted in the same operation.
[2] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.
[3] Included under "Undistributed" to avoid disclosing individual operations.
[4] For purposes of concealment Montana lignite is included with Texas lignite.
[5] Includes Colfax County, N. Mex.
[6] Includes Arizona and California, but excludes Colfax County, N. Mex.
[7] Includes Idaho. No production was reported for Idaho.
[8] Includes Oregon.
[9] Includes operations in districts 1, 2, 3, 4, 6, 7, 10, 12, 14, 21, and 23 in which the output was obtained by both methods. In addition to the 3,680,190 tons produced by stripping, this group of 81 mines obtained 7,243,615 tons by underground methods, their total production by both methods being 10,923,805 tons.
[10] Includes data on underground mining conducted in the same operation.
[11] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

TABLE 34.—*Summary of operations of underground bituminous-coal and lignite mines where shot holes were power-drilled in the United States, by States, in 1942*

State	Number of mines using power drills		Number of power drills								Net tons produced in working places where shot holes were power-drilled			Total production from mines using power drills (net tons)		
			Electric				Compressed air									
	In coal and coal and rock	In rock only	In coal only	In coal and rock	In rock only	Total	In coal only	In coal and rock	In rock only	Total	Electric drills	Compressed air drills	Total	In coal and coal and rock	In rock only	Total
Alabama	51	9	664	168	11	843		1	136	137	12,165,504	5,840	12,171,344	15,314,124	668,092	15,982,216
Alaska	1						12			12		73,417	73,417	73,417		73,417
Arkansas	6	21	18		12	30	1	3	51	55	251,722	3,000	254,722	349,563	1,000,627	1,350,190
Colorado	59	5	278	43	3	324			19	19	4,453,326		4,453,326	6,156,422	810,205	6,966,627
Illinois	125	5	978	92	17	1,087	1		22	23	43,121,143	13,720	43,134,863	44,594,024	594,755	45,188,779
Indiana	27		190	22	5	217			10	10	9,137,316		9,137,316	9,137,316		9,137,316
Iowa	7		28	5		33					356,809		356,809	680,896		680,896
Kansas	2			3		3					(1)		(1)	(1)		(1)
Kentucky	207	22	911	121	62	1,094	14	3	140	157	36,004,628	327,872	36,332,500	44,771,973	3,794,979	48,566,952
Maryland	3	3	14	2	9	25					(1)		(1)	(1)	(1)	(1)
Michigan	3	1	6	2	3	11			1	1	96,919		96,919	172,544	21,109	193,653
Missouri	4	7	4	1	3	8		1	5	6	94,603	41,964	136,567	136,567	287,057	423,624
Montana (bituminous and lignite)	10		47	1	1	49			1	1	1,905,615		1,905,615	1,905,615		1,905,615
New Mexico	4		28			28			4	4	(1)		(1)	(1)	(1)	(1)
North-South Dakota (lignite)	25	1	40		1	41					537,155		537,155	537,155	6,737	543,892
Ohio	45	6	289	84	28	401			8	8	15,570,849		15,570,849	16,911,243	593,986	17,505,229
Oklahoma	5	1	4	5		9		2	2	4	38,948	34,978	73,926	386,648	39,754	426,402
Pennsylvania	149	63	1,078	304	124	1,506	87	2	452	541	52,546,015	4,600,956	57,146,971	77,621,791	19,517,188	97,138,979
Tennessee	25	11	99	10	6	115			36	36	2,639,310		2,639,310	3,978,658	1,623,804	5,602,462
Utah	21		117	2	4	123			17	17	5,160,859		5,160,859	5,205,691		5,205,691
Virginia	32	12	184		10	194	1		49	50	7,966,807	5,294	7,972,101	10,188,699	3,910,398	14,099,097
Washington	19		105	17		122	82	10	34	126	745,078	844,980	1,590,058	1,760,014		1,760,014
West Virginia	281	55	1,535	204	70	1,809	29	3	284	316	73,453,719	591,887	74,045,606	106,848,769	17,414,857	124,263,626
Wyoming	31		383	27		410	34		7	41	7,720,291	105,921	7,826,212	7,826,212		7,826,212
Undistributed											913,785		913,785	1,118,394	95,743	1,214,137
Total	1,142	222	7,000	1,113	369	8,482	261	25	1,278	1,564	274,880,401	6,649,829	281,530,230	355,675,735	50,379,291	406,055,026

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[1] Included under "Undistributed."

TABLE 35.—*Summary of operations of underground bituminous-coal and lignite mines where shot holes were power-drilled in the United States, by districts, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	Number of mines using power drills		Number of power drills								Net tons produced in working places where shot holes were power-drilled			Total production from mines using power drills (net tons)		
			Electric				Compressed air									
	In coal and coal and rock	In rock only	In coal only	In coal and rock	In rock only	Total	In coal only	In coal and rock	In rock only	Total	Electric drills	Compressed air drills	Total	In coal and coal and rock	In rock only	Total
PRICE AREA 1																
Dist. 1. Eastern Pennsylvania [1]	73	50	693	80	104	877	22	1	362	385	15, 675, 260	560, 272	16, 235, 532	26, 786, 981	8, 574, 354	35, 361, 335
Dist. 2. Western Pennsylvania	80	17	406	226	29	661	65	1	91	157	37, 273, 683	4, 040, 684	41, 314, 367	51, 456, 487	11, 051, 104	62, 507, 591
Dist. 3. Northern West Virginia	61	3	294	79	15	388	2		26	28	25, 021, 296	61. 208	25, 082, 504	30, 273, 394	2, 160, 991	32, 434, 385
Dist. 4. Ohio	45	6	289	84	28	401			8	8	15, 570. 849		15, 570. 849	16, 911, 243	593, 986	17, 505, 229
Dist. 5. Michigan	3	1	6	2	3	11			1	1	96. 919		96, 919	172. 544	21, 109	193, 653
Dist. 6. Panhandle	8		29	62		91					2, 698, 692		2, 698, 692	4, 153, 390		4, 153, 390
Dist. 7. Southern numbered 1	70	44	452	14	20	486	21		175	196	14, 320, 734	430, 324	14, 751, 058	31, 799, 759	13, 751, 556	45, 551, 315
Dist. 8. Southern numbered 2	350	51	1, 678	161	112	1, 951	15	6	300	321	66, 871, 157	419, 494	67, 290, 651	87, 984, 058	10, 818, 964	98, 803, 022
Total, price area 1	690	172	3, 847	708	311	4, 866	125	8	963	1, 096	177. 528, 590	5, 511, 982	183, 040, 572	249, 537, 856	46, 972, 064	296, 509, 920
PRICE AREA 2																
Dist. 9. Western Kentucky	54		258	19	1	278	6		3	9	10, 824, 582	14, 027	10, 838, 609	10, 924, 034		10, 924, 034
Dist. 10. Illinois	125	5	978	92	17	1, 087	1		22	23	43, 121, 143	13, 720	43, 134, 863	44, 594, 024	594, 755	45, 188, 779
Dist. 11. Indiana	27		190	22	5	217			10	10	9, 137, 316		9, 137, 316	9, 137, 316		9, 137, 316
Dist. 12. Iowa	7		28	5		33					356, 809		356, 809	680, 896		680. 896
Total, price area 2	213	5	1, 454	138	23	1, 615	7		35	42	63, 439, 850	27, 747	63, 467, 597	65, 336, 270	594, 755	65, 931, 025
PRICE AREA 3																
Dist. 13. Southeastern	52	10	675	168	11	854		1	140	141	12, 386, 555	5, 840	12, 392, 395	15, 846, 496	668, 092	16, 514, 588

PRICE AREA 4																
Dist. 14. Arkansas-Oklahoma	7	21	19	....	12	31	1	3	51	55	(2)	(2)	260, 291	355, 132	1, 000, 627	1, 355, 759
PRICE AREA 5																
Dist. 15. Southwestern:																
Bituminous	10	8	7	9	3	19	......	3	7	10	(2)	(2)	(2)	(2)	(2)	(2)
Lignite (Texas)	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Total, price area 5	10	8	7	9	3	19	......	3	7	10	(2)	(2)	(2)	(2)	(2)	(2)
PRICE AREA 6																
Dist. 16. Northern Colorado	25	......	140	12	......	152	......	......	......	......	2, 385, 098	......	2, 385, 098	2, 600, 425	......	2, 600, 425
Dist. 17. Southern Colorado[3]	38	5	166	31	3	200	......	......	23	23	(2)	......	(2)	(2)	(2)	(2)
Dist. 18. New Mexico[4]	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Total, price area 6	63	5	306	43	3	352	......	......	23	23	[5] 2, 385, 098	......	[5] 2, 385, 098	[5] 2, 600, 425	(2)	[5] 2, 600, 425
PRICE AREA 7																
Dist. 19. Wyoming[6]	31	......	383	27	......	410	34	......	7	41	7, 720, 291	105, 921	7, 826, 212	7, 826, 212	......	7, 826, 212
Dist. 20. Utah	21	......	117	2	4	123	......	......	17	17	5, 160, 859	......	5, 160, 859	5, 205, 691	......	5, 205, 691
Total, price area 7	52	......	500	29	4	533	34	......	24	58	12, 881, 150	105, 921	12, 987, 071	13, 031, 903	......	13, 031, 903
PRICE AREA 8																
Dist. 21. North-South Dakota (lignite)	25	1	40	......	1	41	......	......	......	......	537, 155	......	537, 155	537, 155	6, 737	543, 892
PRICE AREA 9																
Dist. 22. Montana (bituminous and lignite)	10	......	47	1	1	49	......	......	1	1	1, 905, 615	......	1, 905, 615	1, 905, 615	......	1, 905. 615

See footnotes at end of table.

TABLE 35.—*Summary of operations of underground bituminous-coal and lignite mines where shot holes were power-drilled in the United States, by districts, in 1942*—Continued

Minimum price area and producing district	Number of mines using power drills		Number of power drills								Net tons produced in working places where shot holes were power-drilled			Total production from mines using power drills (net tons)		
			Electric				Compressed air									
	In coal and coal and rock	In rock only	In coal only	In coal and rock	In rock only	Total	In coal only	In coal and rock	In rock only	Total	Electric drills	Compressed air drills	Total	In coal and coal and rock	In rock only	Total
PRICE AREA 10																
Dist. 23. Washington [7]	19	--------	105	17	--------	122	82	10	34	126	745, 078	844, 980	1, 590, 058	1, 760, 014	--------	1, 760, 014
Alaska	1	--------	--------	--------	--------	--------	12	--------	--------	12	--------	73, 417	73, 417	73, 417	--------	73, 417
Total, price area 10	20	--------	105	17	--------	122	94	10	34	138	745, 078	918, 397	1, 663, 475	1, 833, 431	--------	1, 833, 431
Undistributed	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	3, 071, 310	79, 942	2, 890, 961	4, 691, 452	1, 137, 016	5, 828, 468
Grant total [8]	1, 142	222	7, 000	1, 113	369	8, 482	261	25	1, 278	1, 564	274, 880, 401	6, 649, 829	281, 530, 230	355, 675, 735	50, 379, 291	406, 055, 026

[1] Includes Maryland, and Grant, Mineral, and Tucker Counties, W. Va.
[2] Included under "Undistributed."
[3] Includes Colfax County, N. Mex.
[4] Includes Arizona and California, but excludes Colfax County, N. Mex.
[5] Incomplete. Part of total included under "Undistributed."
[6] Includes Idaho. No production was reported for Idaho.
[7] Includes Oregon.
[8] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

See footnotes at end of table.

MECHANICAL LOADING

Mechanical loading devices for use in underground bituminous-coal and lignite mines are divided into two clasess: Those that practically eliminate hand-shoveling, which are known as mobile loaders, scrapers, and self-loading conveyors or duckbills; and those that reduce the labor of hand-shoveling, which are known as hand-loaded face conveyors and pit-car loaders.

In 1923, the first year data were recorded on merchanical loading, 60 mines loaded 1,879,726 net tons (0.3 percent of the total underground output) with the aid of mechanical loading devices. In 1933, 10 years later, 283 mines were using loading devices, and 12 percent of the total underground output was mechanically loaded. Since 1933 the proportion of tonnage mechanically loaded has increased each year and in 1942 amounted to 45 percent of the total underground bituminous coal and lignite mined in the United States.

During 1942 mobile loaders, scrapers, and duckbills handled 71 percent of the underground tonnage mechanically loaded, and hand-loaded conveyors and pit-car loaders handled 29 percent.

Detailed statistics on mechanical loading given in the following tables (36 to 44, inclusive) pertain to underground coal mines and do not include strip mines or equipment used for handling coal on the surface. All tonnage figures on coal mechanically loaded include the initial phase of loading only; for instance, if conveyors were used in conjunction with mobile loaders, the tonnage is shown under mobile loading machines and not under conveyors.

Sales of mechanical loading equipment in 1943.—The estimated capacity of mechanical loading equipment sold for underground use in all coal mines was 32 percent less in 1943 than in 1942. This decrease was due to some of the manufacturers devoting a portion of their facilities to war work. Table 36 shows the sales reported, by type of equipment, and the number of manufacturers reporting for 1936–43.

Sales of conveyors to bituminous-coal and lignite mines in 1943 totaled 798 units. The figures for 1942 and 1943 exclude duckbills, which were included in all previous years. Therefore, the figures for 1942 and 1943 are not comparable with those for 1941 or earlier years. By excluding sales of duckbills, some of the overlapping sales of conveyors are eliminated. For instance, in 1941 there were 3,595 conveyors, including those hand-loaded and those equipped with duckbills, in active use at bituminous-coal and lignite mines, as reported by mine operators. By adding 1941 conveyor and duckbill sales of 1,800 units, 5,395 units appeared available for use in 1942, whereas the actual number reported in use by mine operators was 4,103, or 1,292 less. This difference represents idle or worn-out and obsolete equipment, duplications in reporting sales, and a small number of conveyors used in conjunction with mobile loaders.

The number of mobile loaders, scrapers, and conveyors shipped into the various States and groups of States in 1943 and the number of units in actual use in 1942 are shown in table 38. West Virginia received 27 percent of the mobile loaders and 40 percent of the conveyor units sold to bituminous-coal and lignite mines in 1943.

Detailed statistics of mechanical loading in bituminous-coal and lignite mines in 1942, by types of equipment.—During 1942 the approximate percentage of the tonnage loaded by each type of equipment was as follows: Mobile loaders, 69; hand-loaded conveyors, 20; duckbills, 9; pit-car loaders, 1; and scrapers, 1.

Mobile loaders handle more coal than all the other types of mechanical loading devices combined. Where coal is loaded by mobile loaders it is most commonly loaded directly into mine cars, but some tonnage is loaded into shuttle cars or onto conveyors. During 1942, 81 percent of the bituminous coal and lignite handled by mobile loaders was loaded directly into mine cars, 16 percent into shuttle cars, and 3 percent onto conveyors.

During 1942 in underground bituminous coal and lignite mines 2,301 mobile loaders handled 160,300,935 net tons, an average of 69,666 tons per mobile loader per year; scrapers averaged 15,103; pit-car loaders, 6,760; duckbills, 19,476; and hand-loaded face conveyors, 15,542 per year per unit for the same period (see tables 37 and 39).

Mechanical loading, by States.—West Virginia has been the leading producer of mechanically loaded coal since 1939. During 1942 West Virginia produced 70,081,749 net tons of mechanically loaded coal, followed by Pennsylvania with 42,139,366 net tons, Illinois with 41,453,190, Kentucky with 16,931,124, and Ohio with 15,451,347. These five States produced 80 percent of the total output of underground mechanically loaded bituminous coal in the United States in 1942.

Detailed data by States, on the number of mines amd machines and the production of mechanically loaded coal compared with total production at mines using mechanical loading devices are given in table 40, and similar data by Coal Act districts are shown in table 41. Comparative changes in underground mechanical loading in 1941–42, by States and Coal Act districts, are shown in tables 42 and 43.

Table 44 gives bituminous coal and lignite mined by stripping compared with underground hand-loaded and machine-loaded tonnage by States, for 1942.

TABLE 36.—*Units of mechanical loading equipment sold to bituminous-coal and lignite mines for underground use in the United States, as reported by manufacturers, 1936-43, inclusive*

	1936	1937	1938	1939	1940	1941	1942	1943	Change, 1943 from 1942 (percent)
Type of equipment:									
Mobile loaders	344	292	241	292	233	367	352	234	−33.5
Scrapers [1]	19	13	6	18	36	8	15	13	−13.3
Pit-car loaders	9	32	139	2	3	10	2	1	−50.0
Conveyors [2]	682	835	749	1,095	1,573	1,800	1,167	798	−31.6
Total, all types	1,054	1,172	1,135	1,407	1,845	2,185	1,536	1,046	−31.9
Number of manufacturers reporting	28	29	29	31	32	32	28	24	....

[1] Reported as scrapers or scraper haulers and hoists.

[2] Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads. Sales of both loading heads and shaker conveyors were counted for the years 1936–41, inclusive, but the figures for 1942 and 1943 do not include loading heads separately.

TABLE 37.—*Units of mechanical loading equipment in use in underground bituminous-coal and lignite mines in the United States, 1936–42*

	1936	1937	1938	1939	1940	1941	1942	Change, 1942 from 1941 (percent)
Type of equipment:								
Mobile loaders	980	(1)	1,405	1,573	1,720	1,985	2,301	+15.9
Scrapers	106	(1)	117	131	116	109	93	−14.7
Pit-car loaders	1,851	(1)	1,392	873	697	607	481	−20.8
Conveyors equipped with duckbills or other self-loading heads	234	(1)	346	559	656	788	1,062	+34.8
Hand-loaded conveyors	936	(1)	1,526	1,834	2,263	2,807	3,041	+8.3
Total, all types	4,107	(1)	4,786	4,970	5,452	6,296	6,978	+10.8

[1] Data not available.

TABLE 38.—*Comparison of mobile loaders, scrapers, and conveyers in actual use in bituminous-coal and lignite mines in the United States in 1942 with sales reported in 1943, by States and regions.*

State and region	Mobile loaders		Scrapers		Conveyors [1]	
	In use in 1942	Sales in 1943	In use in 1942	Sales in 1943	In use in 1942	Sales in 1943
Northern Appalachian States:						
Pennsylvania	477	52	6	5	869	70
Maryland					27	
Ohio	151	11			192	17
Michigan					5	
Southern Appalachian States:						
Alabama	59	12	51	1	372	55
Kentucky	178	15		1	352	54
Tennessee	4	9		1	111	7
West Virginia	533	63	4	1	1,170	317
Virginia	45	8		1	107	14
Middle Western States:						
Illinois	559	23			26	22
Indiana	142	7				
Trans-Mississippi States [2]	153	34	32	3	872	242
Total	2,301	234	93	13	4,103	798

[1] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[2] Includes Arkansas, Colorado, Iowa, Montana, New Mexico, North Dakota, Oklahoma, Utah, Washington, Wyoming, and Alaska.

TABLE 39.—*Bituminous-coal and lignite mechanically loaded underground in the United States, by types of machines, 1941–42*

Type of equipment	1941		1942	
	Net tons	Percent	Net tons	Percent
Mobile loaders	126,478,074	67.8	160,300,935	68.8
Scrapers	1,289,710	.7	1,404,569	.6
Pit-car loaders	3,447,028	1.8	3,251,469	1.4
Conveyors equipped with duckbills or other self-loading heads	14,918,583	8.0	20,683,558	8.9
Hand-loaded conveyors	40,533,855	21.7	47,262,389	20.3
Grand total loaded mechanically	186,667,250	100.0	232,902,920	100.0

TABLE 40.—*Mechanical loading underground in bituminous-coal and lignite mines in the United States, by districts, in 1942*

[This table includes all soft coal mines that produced any part of their tonnage with the aid of mechanical loading devices in 1942]

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	Number of mines				Number of machines					Production mechanically loaded (net tons)			Total production at mines using mechanical loading devices (net tons)			
	Using loading machines only [1]	Using conveyors only [2]	Using both loading machines and conveyors	Total	Mobile loading machines	Scrapers	Conveyors equipped with duckbills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors [3]	Loaded by machines [1]	Handled by conveyors [2]	Total	Mines using loading machines only [1]	Mines using conveyors only [2]	Mines Using both loading machines and conveyors	Total
PRICE AREA 1																
Dist. 1. Eastern Pennsylvania [4]	15	67	18	100	85	4	27	......	752	5,160,911	10,776,333	15,937,244	7,923,402	13,819,302	8,898,847	30,641,551
Dist. 2. Western Pennsylvania	64	7	8	79	392	2	39	141	97	25,044,471	1,896,851	26,941,322	40,332,039	2,503,664	3,525,404	46,361,107
Dist. 3. Northern West Virginia	50	9	2	61	220	......	8	......	70	22,166,758	1,020,721	23,187,479	27,550,813	(5)	(5)	30,301,805
Dist. 4. Ohio	28	7	4	39	151	......	135	1	57	14,324,083	1,127,264	15,451,347	14,842,058	383,827	1,557,227	16,783,112
Dist. 5. Michigan	......	1	......	1	......	......	......	......	5	......	(5)	(5)	......	(5)	......	(5)
Dist. 6. Panhandle	3	2	4	9	30	......	21	......	43	1,874,883	996,730	2,871,613	(5)	(5)	1,971,375	4,161,175
Dist. 7. Southern numbered 1	20	51	15	86	79	3	58	83	405	6,674,365	7,980,949	14,655,314	13,662,226	13,473,859	7,397,660	34,533,745
Dist. 8. Southern numbered 2	95	98	54	247	364	1	181	......	790	29,442,016	14,773,834	44,215,850	32,895,117	21,464,817	17,502,928	71,862,862
Total, price area 1	275	242	105	622	1,321	10	469	225	2,219	104,687,487	[6] 38,572,682	[6] 143,260,169	[6] 137,205,655	[6] 51,645,469	[6] 40,853,441	[6] 234,645,357
PRICE AREA 2																
Dist. 9. Western Kentucky	31	2	3	36	67	......	116	16	11	7,386,284	435,335	7,821,619	7,179,168	(5)	(5)	8,658,403
Dist. 10. Illinois	52	3	14	69	559	......	16	176	10	40,301,358	1,151,832	41,453,190	35,658,421	301,519	7,286,408	43,246,348
Dist. 11. Indiana	20	1	3	24	142	......	......	22	......	8,968,001	156,278	9,124,279	8,676,793	(5)	(5)	9,264,246
Dist. 12. Iowa	2	3	......	5	2	......	14	......	11	(5)	(5)	305,692	(5)	(5)	......	537,023
Total, price area 2	105	9	20	134	770	......	146	214	32	[6] 56,655,643	[6] 1,743,445	58,704,780	[6] 51,514,382	[6] 301,519	[6] 7,286,408	61,706,020
PRICE AREA 3																
Dist. 13. Southeastern	19	25	9	53	59	51	22	6	368	3,641,336	5,356,350	8,997,686	5,835,710	4,682,966	5,481,214	15,999,890

See footnotes at end of table.

PRICE AREA 4																
Dist. 14. Arkansas-Oklahoma	2	26		28		11			74	(5)	(5)	1,310,732	(5)	(5)		1,336,855
PRICE AREA 5																
Dist. 15. Southwestern: Bituminous		8		8					61		535,197	535,197		537,839		537,839
Lignite (Tex.)																
Total, price area 5		8		8					61		535,197	535,197		537,839		537,839
PRICE AREA 6																
Dist. 16. Northern Colorado	18	6		24	10		97	3	18	1,766,576	145,475	1,912,051	2,226,610	238,126		2,464,736
Dist. 17. Southern Colorado [7]	17	16	3	36	24	13	52	1	85	(5)	629,219	(5)	(5)	879,707	596,721	(5)
Dist. 18. New Mexico [8]																
Total, price area 6	35	22	3	60	34	13	149	4	103	[6] 1,766,576	774,694	[6] 1,912,051	[6] 2,226,610	1,117,833	596,721	[6] 2,464,736
PRICE AREA 7																
Dist. 19. Wyoming [9]	14	10	6	30	23	7	233	26	54	6,949,283	757,856	7,707,139	6,000,747	390,223	1,392,709	7,783,679
Dist. 20. Utah	8	6	7	21	44		30		45	4,224,900	477,478	4,702,378	3,588,756	224,873	1,348,433	5,162,062
Total, price area 7	22	16	13	51	67	7	263	26	99	11,174,183	1,235,334	12,409,517	9,589,503	615,096	2,741,142	12,945,741
PRICE AREA 8																
Dist. 21. North-South Dakota (lignite)	2			2	5					(5)		(5)	(5)			(5)
PRICE AREA 9																
Dist. 22. Montana (bituminous)	6		1	7	44		2	6		(5)	(5)	1,867,655	(5)		(5)	1,892,559
PRICE AREA 10																
Dist. 23. Washington [10]	4	7		11	1	1	11		85	86,698	938,515	1,025,213	358,593	959,662		1,318,255
Alaska																
Total, price area 10	4	7		11	1	1	11		85	86,698	938,515	1,025,213	358,593	959,662		1,318,255
Undistributed										4,377,139	1,357,641	2,879,920	7,039,533	4,127,304	3,195,426	5,064,774
Grand total [11]	470	355	151	976	2,301	93	1,062	481	3,041	182,389,062	50,513,858	232,902,920	213,769,986	63,987,688	60,154,352	337,912,026

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[1] Includes those mines in which all of the tonnage mechanically loaded was obtained with machines that substantially eliminate hand shoveling; that is, mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads. Some mines in this class also use conveyors in conjunction with mobile loaders to perform the initial phase of transportation.

[2] Includes those mines in which all the tonnage mechanically loaded was obtained with hand-loaded conveyors and pit-car loaders.

[3] Number of units.

[4] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[5] Included under "Undistributed" to avoid disclosing individual operations.

[6] Incomplete. Part of total included under "Undistributed."

[7] Includes Colfax County, N. Mex.

[8] Includes Arizona and California, but excludes Colfax County, N. Mex.

[9] Includes Idaho. No production was reported for Idaho.

[10] Includes Oregon.

[11] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

TABLE 41.—*Mechanical loading underground in bituminous-coal and lignite mines in the United States, by States, in 1942*

[This table includes all soft-coal mines that produced any part of their tonnage with the aid of mechanical loading devices in 1942]

State	Number of mines				Number of machines					Production mechanically loaded (net tons)			Total production at mines using mechanical loading devices (net tons)			
	Using loading machines only [1]	Using conveyors only [2]	Using both loading machines and conveyors	Total	Mobile loading machines	Scrapers	Conveyors equipped with duckbills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors [3]	Loaded by machines [1]	Handled by conveyors [2]	Total	Mines using loading machines only [1]	Mines using conveyors only [2]	Mines using both loading machines and conveyors	Total
Alabama	19	23	9	51	59	51	22	6	350	3,641,336	5,146,771	8,788,107	5,835,710	3,718,814	5,481,214	15,035,738
Arkansas	2	23	------	25	------	11	------	------	67	(4)	(4)	1,265,932	(4)	(4)	------	1,282,835
Colorado	31	22	3	56	25	------	149	4	103	3,059,744	774,694	3,834,438	4,333,833	1,117,833	596,721	6,048,387
Illinois	52	3	14	69	559	------	16	176	10	40,301,358	1,151,832	41,453,190	35,658,421	301,519	7,286,408	43,246,348
Indiana	20	1	3	24	142	------	------	22	------	8,968,001	156,278	9,124,279	8,676,793	(4)	(4)	9,264,246
Iowa	2	3	------	5	2	------	14	------	11	(4)	(4)	305,692	(4)	(4)	------	537,023
Kentucky	65	33	9	107	178	------	187	16	165	14,452,385	2,478,739	16,931,124	17,085,897	7,612,863	4,479,976	29,178,736
Maryland	------	3	------	3	------	------	------	------	27	------	(4)	(4)	------	(4)	------	(4)
Michigan	------	1	------	1	------	------	------	------	5	------	(4)	(4)	------	(4)	------	(4)
Montana (bituminous)	6	------	1	7	44	------	2	6	------	(4)	(4)	1,867,655	(4)	------	(4)	1,892,559
New Mexico	4	------	------	4	9	13	------	------	------	(4)	------	(4)	(4)	------	------	(4)
North Dakota (lignite)	2	------	------	2	5	------	------	------	------	(4)	------	(4)	(4)	------	------	(4)
Ohio	28	7	4	39	151	------	135	1	57	14,324,083	1,127,264	15,451,347	14,842,058	383,827	1,557,227	16,783,112
Oklahoma	------	11	------	11	------	------	------	------	68	------	579,997	579,997	------	591,859	------	591,859
Pennsylvania	79	66	26	171	477	6	66	141	803	30,205,382	11,933,984	42,139,366	48,255,441	15,150,014	12,424,251	75,829,706
Tennessee	3	16	5	24	4	------	15	------	96	190,480	1,643,120	1,833,600	687,842	2,470,835	875,807	4,034,484
Utah	8	6	7	21	44	------	30	------	45	4,224,900	477,478	4,702,378	3,588,756	224,873	1,348,433	5,162,062
Virginia	16	6	4	26	45	------	15	------	92	2,784,250	1,660,393	4,444,643	5,427,664	1,420,460	980,468	7,828,592
Washington	4	7	------	11	1	1	11	------	85	86,698	938,515	1,025,213	358,593	959,662	------	1,318,255
West Virginia	115	114	60	289	533	4	167	83	1,003	50,117,191	19,964,558	70,081,749	59,550,004	27,508,334	23,028,388	110,086,726
Wyoming	14	10	6	30	23	7	233	26	54	6,949,283	757,856	7,707,139	6,000,747	390,223	1,392,709	7,783,679
Undistributed:																
East of Mississippi River	------	------	------	------	------	------	------	------	------	------	481,251	481,251	------	2,136,572	702,750	668,519
West of Mississippi River	------	------	------	------	------	------	------	------	------	3,083,971	1,241,128	885,820	3,468,227			1,339,160
Total: 1942	470	355	151	976	2,301	93	1,062	481	3,041	182,389,062	50,513,858	232,902,920	213,769,986	63,987,688	60,154,352	337,912,026
1941	409	[5] 349	[5] 139	897	1,985	109	788	607	2,807	142,686,367	43,980,883	186,667,250	170,000,298	59,537,039	50,577,004	280,114,341
Change, 1942 over 1941 (percent)	+14.9	+1.7	+8.6	+8.8	+15.9	−14.7	+34.8	−20.8	+8.3	+27.8	+14.9	+24.8	+25.7	+7.5	+18.9	+20.6

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[1] Includes those mines in which all of the tonnage mechanically loaded was obtained with machines that substantially eliminate hand shoveling, that is, mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads. Some mines in this class also use conveyors in conjunction with mobile loaders to perform the initial phase of transportation.

[2] Includes those mines in which all the tonnage mechanically loaded was obtained with hand-loaded conveyors and pit-car loaders.

[3] Number of units.

[4] Included under "Undistributed" to avoid disclosing individual operations.

[5] Revised.

TABLE 42.—*Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of machines in the United States, by States, 1941–42*

State	1941, net tons			1942, net tons			Percent handled by each class			
							1941		1942	
	Loaded by machines[1]	Handled by conveyors[2]	Total	Loaded by machines[1]	Handled by conveyors[2]	Total	Loaded by machines[1]	Handled by conveyors[2]	Loaded by machines[1]	Handled by conveyors[2]
Alabama	2, 006, 569	3, 841, 428	5, 847, 997	3, 641, 336	5, 146, 771	8, 788, 107	34. 3	65. 7	41. 4	58. 6
Arkansas	(3)	(3)	1, 053, 603	(3)	(3)	1, 265, 932	(3)	(3)	(3)	(3)
Colorado	2, 090, 978	851, 409	2, 942, 387	3, 059, 744	774, 694	3, 834, 438	71. 1	28. 9	79. 8	20. 2
Illinois	32, 173, 463	1, 100, 513	33, 273, 976	40, 301, 358	1, 151, 832	41. 453, 190	96. 7	3. 3	97. 2	2. 8
Indiana	8, 070, 401	189, 901	8, 260, 302	8, 968, 001	156, 278	9, 124, 279	97. 7	2. 3	98. 3	1. 7
Iowa	(3)	(3)	174, 958	(3)	(3)	305, 692	(3)	(3)	(3)	(3)
Kentucky	9, 631, 877	1, 864, 801	11, 496, 678	14, 452, 385	2. 478, 739	16, 931, 124	83. 8	16. 2	85. 4	14. 6
Maryland	----------	(3)	(3)	----------	(3)	(3)	----------	100. 0	----------	100. 0
Michigan	----------	(3)	(3)	----------	(3)	(3)	----------	100. 0	----------	100. 0
Montana (bituminous)	(3)	(3)	1, 621, 024	(3)	(3)	1, 867, 655	(3)	(3)	(3)	(3)
New Mexico	(3)	----------	(3)	(3)	----------	(3)	100. 0	----------	100. 0	----------
North Dakota (lignite)	(3)	----------	(3)	(3)	----------	(3)	100. 0	----------	100. 0	----------
Ohio	10, 860, 007	1, 083, 598	11, 943, 605	14, 324, 083	1, 127, 264	15, 451, 347	90. 9	9. 1	92. 7	7. 3
Oklahoma	----------	421, 973	421, 973	----------	579, 997	579, 997	----------	100. 0	----------	100. 0
Pennsylvania	23, 807, 589	11, 357, 375	35, 164, 964	30. 205, 382	11, 933, 984	42, 139, 366	67. 7	32. 3	71. 7	28. 3
Tennessee	144, 414	1, 276, 989	1, 421, 403	190, 480	1, 643, 120	1, 833, 600	10. 2	89. 8	10. 4	89. 6
Utah	2, 878, 639	488, 209	3, 366, 848	4, 224, 900	477, 478	4, 702, 378	85. 5	14. 5	89. 8	10. 2
Virginia	2, 458, 841	1, 434, 171	3, 893, 012	2, 784, 250	1, 660, 393	4, 444, 643	63. 2	36. 8	62. 6	37. 4
Washington	94, 760	923, 632	1, 018, 392	86, 698	938, 515	1, 025, 213	9. 3	90. 7	8. 5	91. 5
West Virginia	40, 556, 952	16, 955, 016	57, 511, 968	50, 117, 191	19, 964, 558	70, 081, 749	70. 5	29. 5	71. 5	28. 5
Wyoming	5, 517, 515	659, 930	6, 177, 445	6, 949, 283	757, 856	7, 707, 139	89. 3	10. 7	90. 2	9. 8
Undistributed:										
East of Mississippi River	----------	441, 813	441, 813	----------	481, 251	481, 251	----------	(4)	(4)	(4)
West of Mississippi River	2, 394, 362	1, 090, 125	634, 902	3, 083, 971	1, 241, 128	885, 820	(4)	(4)	(4)	(4)
Total	142, 686, 367	43, 980, 883	186, 667, 250	182, 389, 062	50, 513, 858	232, 902, 920	76. 4	23. 6	78. 3	21. 7

[1] Includes mobile loaders, scrapers and duckbills.

[2] Includes hand-loaded conveyors and pit-car loaders.

[3] Included under "Undistributed" to avoid disclosing individual operations.

[4] Included in total; percentage by types not given because State groups are not comparable.

TABLE 43.—*Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of machines in the United States, by districts, 1941–42*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimm price area and producing district	1941, net tons			1942, net tons			Percent handled by each class			
							1941		1942	
	Loaded by machines [1]	Handled by conveyors [2]	Total	Loaded by machines [1]	Handled by conveyors [2]	Total	Loaded by machines [1]	Handled by conveyors [2]	Loaded by machines [1]	Handled by conveyors [2]
PRICE AREA 1										
Dist. 1. Eastern Pennsylvania [3]	3, 150, 773	10, 143, 652	13, 294, 425	5, 160, 911	10, 776, 333	15, 937, 244	23. 7	76. 3	32. 4	67. 6
Dist. 2. Western Pennsylvania	20, 656, 816	1, 929, 463	22, 586, 279	25, 044, 471	1, 896. 851	26, 941, 322	91. 5	8. 5	93. 0	7. 0
Dist. 3. Northern West Virginia	18, 074, 376	723, 327	18, 797, 703	22, 166, 758	1, 020, 721	23, 187, 479	96. 2	3. 8	95. 6	4. 4
Dist. 4. Ohio	10, 860, 007	1, 083, 598	11, 943, 605	14, 324, 083	1, 127, 264	15, 451, 347	90. 9	9. 1	92. 7	7. 3
Dist. 5. Michigan		(4)	(4)		(4)	(4)		100. 0		100. 0
Dist. 6. Panhandle	1, 726, 075	898, 956	2, 625, 031	1, 874, 883	996, 730	2, 871, 613	65. 8	34. 2	65. 3	34. 7
Dist. 7. Southern numbered 1	4, 522, 159	6, 491, 753	11, 013, 912	6, 674, 365	7, 980, 949	14, 655, 314	41. 1	58. 9	45. 5	54. 5
Dist. 8. Southern numbered 2	23, 644, 049	12, 566, 121	36, 210, 170	29, 442, 016	14, 773, 834	44, 215, 850	65. 3	34. 7	66. 6	33. 4
Total, price area 1	82, 634, 255	[5] 33, 836, 870	[5] 116, 471, 125	104, 687, 487	[5] 38, 572, 682	[5] 143, 260, 169	[5] 71. 0	[5] 29. 0	[5] 73. 1	[5] 26. 9
PRICE AREA 2										
Dist. 9. Western Kentucky	4, 825, 425	294, 148	5, 119, 573	7, 386, 284	435, 335	7, 821, 619	94. 3	5. 7	94. 4	5. 6
Dist. 10. Illinois	32, 173, 463	1, 100, 513	33, 273, 976	40, 301, 358	1, 151, 832	41, 453, 190	96. 7	3. 3	97. 2	2. 8
Dist. 11. Indiana	8, 070, 401	189, 901	8, 260, 302	8, 968, 001	156, 278	9, 124, 279	97. 7	2. 3	98. 3	1. 7
Dist. 12. Iowa	(4)	(4)	174, 958	(4)	(4)	305, 692	(4)	(4)	(4)	(4)
Total, price area 2	[5] 45, 069, 289	[5] 1, 584, 562	46, 828, 809	[5] 56, 655, 643	[5] 1, 743, 445	58, 704, 780	[5] 96. 6	[5] 3. 4	[5] 97. 0	[5] 3. 0
PRICE AREA 3										
Dist. 13. Southeastern	2, 006, 569	4, 082, 283	6, 088, 852	3, 641, 336	5, 356, 350	8, 997, 686	33. 0	67. 0	40. 5	59. 5
PRICE AREA 4										
Dist. 14. Arkansas-Oklahoma	(4)	(4)	1, 097, 254	(4)	(4)	1, 310, 732	(4)	(4)	(4)	(4)
PRICE AREA 5										
Dist. 15. Southwestern:										
Bituminous coal		378, 322	378, 322		535, 197	535, 197		100. 0		100. 0
Lignite (Tex.)										
Total, price area 5		378, 322	378, 322		535, 197	535, 197		100. 0		100. 0

Dist. 16. Northern Colorado	1,282,312	312,235	1,594,547	1,766,576	145,475	1,912,051	80.4	19.6	92.4	7.6
Dist. 17. Southern Colorado [6]	(4)	539,174	(4)	(4)	629,219	(4)	(4)	(4)	(4)	(4)
Dist. 18. New Mexico [7]										
Total, price area 6	[5] 1,282,312	851,409	[5] 1,594,547	[5] 1,766,576	774,694	[5] 1,912,051	[5] 80.4	[5] 19.6	[5] 92.4	[5] 7.6
PRICE AREA 7										
Dist. 19. Wyoming [8]	5,517,515	659,930	6,177,445	6,949,283	757,856	7,707,139	89.3	10.7	90.2	9.8
Dist. 20. Utah	2,878,639	488,209	3,366,848	4,224,900	477,478	4,702,378	85.5	14.5	89.8	10.2
Total, price area 7	8,396,154	1,148,139	9,544,293	11,174,183	1,235,334	12,409,517	88.0	12.0	90.0	10.0
PRICE AREA 8										
Dist. 21. North-South Dakota (lignite)	(4)		(4)	(4)		(4)	100.0		100.0	
PRICE AREA 9										
Dist. 22. Montana (bituminous)	(4)	(4)	1,621,024	(4)	(4)	1,867,655	(4)	(4)	(4)	(4)
PRICE AREA 10										
Dist. 23. Washington [9]	94,760	923,632	1,018,392	86,698	938,515	1,025,213	9.3	90.7	8.5	91.5
Alaska										
Total, price area 10	94,760	923,632	1,018,392	86,698	938,515	1,025,213	9.3	90.7	8.5	91.5
Undistributed	3,203,028	1,175,666	2,024,632	4,377,139	1,357,641	2,879,920	(10)	(10)	(10)	(10)
Grand total [11]	142,686,367	43,980,883	186,667,250	182,389,062	50,513,858	232,902,920	76.4	23.6	78.3	21.7

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[1] Includes mobile loaders, scrapers, and duckbills.

[2] Includes hand-loaded conveyors and pit-car loaders.

[3] Includes Maryland, and Grant, Mineral, and Tucker Counties, W. Va.

[4] Included under "Undistributed" to avoid disclosing individual operations.

[5] Incomplete. Part of total included under "Undistributed."

[6] Includes Colfax County, N. Mex.

[7] Includes Arizona and California, but excludes Colfax County, N. Mex.

[8] Includes Idaho. No production was reported for Idaho.

[9] Includes Oregon.

[10] Included in total; percentage by types not given because State groups are not comparable.

[11] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

TABLE 44.—*Bituminous coal and lignite in the United States mined underground and from strip pits and method of loading underground, in net tons, by States, in 1942*

State	Mined by stripping	Mined underground			Grand total production
		Hand-loaded	Machine-loaded	Total	
Alabama	299,983	10,213,164	8,788,107	19,001,271	19,301,254
Alaska	-----	260,893	-----	260,893	260,893
Arizona	-----	11,373		11,373	11,373
Arkansas	182,835	536,626	1,265,932	1,802,558	1,985,393
Colorado	6,755	4,244,487	3,834,438	8,078,925	8,085,680
Georgia	-----	30,913	-----	30,913	30,913
Illinois	15,835,348	7,782,281	41,453,190	49,235,471	65,070,819
Indiana	14,475,660	1,788,112	9,124,279	10,912,391	25,388,051
Iowa	704,762	1,937,268	305,692	2,242,960	2,947,722
Kansas	3,617,813	612,045	-----	612,045	4,229,858
Kentucky	1,436,160	43,863,482	16,931,124	60,794,606	62,230,766
Maryland	23,465	(1)	(1)	1,977,469	2,000,934
Michigan	-----	(1)	(1)	231,148	231,148
Missouri	2,340,354	1,179,523	-----	1,179,523	3,519,877
Montana (bituminous)	1,706,749	205,140	1,867,655	2,072,795	3,779,544
Montana and Texas (lignite)	86,717	253,390	-----	253,390	340,107
New Mexico	-----	(1)	(1)	1,668,659	1,668,659
North Dakota (lignite)	1,715,489	(1)	(1)	821,527	2,537,016
Ohio	9,324,641	7,988,480	15,451,347	23,439,827	32,764,468
Oklahoma	1,101,653	705,542	579,997	1,285,539	2,387,192
Oregon	-----	2,137	-----	2,137	2,137
Pennsylvania	11,456,529	90,477,294	42,139,366	132,616,660	144,073,189
South Dakota (lignite)	49,176	4,362	-----	4,362	53,538
Tennessee	-----	6,324,637	1,833,600	8,158,237	8,158,237
Texas (bituminous)	-----	13,210	-----	13,210	13,210
Utah	-----	814,471	4,702,378	5,516,849	5,516,849
Virginia	-----	15,691,536	4,444,643	20,136,179	20,136,179
Washington	39,511	888,485	1,025,213	1,913,698	1,953,209
West Virginia	2,613,094	83,186,654	70,081,749	153,268,403	155,881,497
Wyoming	185,969	240,117	7,707,139	7,947,256	8,133,225
Undistributed	-----	3,331,732	1,367,071	-----	-----
Total	67,202,663	282,587,354	232,902,920	515,490,274	582,692,937

[1] Included under "Undistributed."

TABLE 45.—*Bituminous coal and lignite in the United States mined underground and from strip pits and method of loading underground, in net tons, by districts, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	Mined by stripping	Mined underground			Grand total production
		Hand-loaded	Machine-loaded	Total	
PRICE AREA 1					
Dist. 1. Eastern Pennsylvania[1]	4,679,531	37,547,034	15,937,244	53,484,278	58,163,809
Dist. 2. Western Pennsylvania	6,800,463	55,111,289	26,941,322	82,052,611	88,853,074
Dist. 3. Northern West Virginia	1,598,132	14,097,435	23,187,479	37,284,914	38,883,046
Dist. 4. Ohio	9,324,641	7,988,480	15,451,347	23,439,827	32,764,468
Dist. 5. Michigan	-----	(2)	(2)	231,148	231,148
Dist. 6. Panhandle	878,665	1,754,717	2,871,613	4,626,330	5,504,995
Dist. 7. Southern numbered 1	136,297	49,804,685	14,655,314	64,459,999	64,596,296
Dist. 8. Southern numbered 2	136,904	77,156,473	44,215,850	121,372,323	121,509,227
Total, price area 1	23,554,633	[3] 243,460,113	[3] 143,260,169	386,951,430	410,506,063
PRICE AREA 2					
Dist. 9. Western Kentucky	1,299,256	4,310,149	7,821,619	12,131,768	13,431,024
Dist. 10. Illinois	15,835,348	7,782,281	41,453,190	49,235,471	65,070,819
Dist. 11. Indiana	14,475,660	1,788,112	9,124,279	10,912,391	25,388,051
Dist. 12. Iowa	704,762	1,937,268	305,692	2,242,960	2,947,722
Total, price area 2	32,315,026	15,817,810	58,704,780	74,522,590	106,837,616

See footnotes at end of table.

TABLE 45.—*Bituminous coal and lignite in the United States mined underground and from strip pits and method of loading underground, in net tons, by districts in 1942*—Continued

Minimum price area and producing district	Mined by stripping	Mined underground			Grand total production
		Hand-loaded	Machine-loaded	Total	
PRICE AREA 3					
Dist. 13. Southeastern	299,983	11.573,829	8,997,686	20,571,515	20,871,498
PRICE AREA 4					
Dist. 14. Arkansas-Oklahoma	235,939	953,920	1,310,732	2,264,652	2,500,591
PRICE AREA 5					
Dist. 15. Southwestern:					
Bituminous	7,006,716	2,093,026	535,197	2,628,223	9,634,939
Lignite (Texas) [4]	86,717	253,390		253,390	340,107
Total, price area 5 [4]	7,093,433	2,346,416	535,197	2,881,613	9,975,046
PRICE AREA 6					
Dist. 16. Northern Colorado	6,755	789,110	1,912,051	2,701,161	2,707,916
Dist. 17. Southern Colorado [5]		(2)	(2)	6,296,056	6,296,056
Dist. 18. New Mexico [6]		761,740		761,740	761,740
Total, price area 6	6,755	[3] 1,550,850	[3] 1,912,051	9,758,957	9,765,712
PRICE AREA 7					
Dist. 19. Wyoming [7]	185,969	240,117	7,707,139	7,947,256	8,133,225
Dist. 20. Utah		814,471	4,702,378	5,516,849	5,516,849
Total, price area 7	185,969	1,054,588	12,409,517	13,464,105	13,650,074
PRICE AREA 8					
Dist. 21. North-South Dakota (lignite).	1,764,665	(2)	(2)	825,889	2,590,554
PRICE AREA 9					
Dist. 22. Montana [4]	1,706,749	205,140	1,867,655	2,072,795	3,779,544
PRICE AREA 10					
Dist. 23. Washington [8]	39,511	890,622	1,025,213	1,915,835	1,955,346
Alaska		260,893		260,893	260,893
Total, price area 10	39,511	1,151,515	1,025,213	2,176,728	2,216,239
Undistributed		4,473,173	2,879,920		
Grand total [9]	67,202,663	282,587,354	232,902,920	515,490,274	582,692,937

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[1] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[2] Included under "Undistributed."

[3] Incomplete. Part of total included under "Undistributed."

[4] For purposes of concealment of individual operators' figures, Montana lignite with production of 49,138 tons has been included with Texas lignite.

[5] Includes Colfax County, N. Mex.

[6] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[7] Includes Idaho. No production was reported for Idaho.

[8] Includes Oregon.

[9] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania.

MECHANICAL CLEANING

In 1906, when the first statistics were recorded on bituminous-coal cleaning, 9,251,946 net tons were cleaned by wet methods at the mines. Pneumatic cleaning was introduced in 1919, but the first statistics begin with 1927, when 3,650,584 net tons were cleaned at the mines.

In 1927, the first year complete data were collected on mechanical cleaning of bituminous coal, 27,692,047 net tons were cleaned, which was 5 percent of the total output. This percentage has increased each year, and in 1942 amounted to 24, or 142,187,346 net tons of clean coal.

Tables 46, 47, 50, 51, 52, and 53 include mechanical cleaning data on all coal mined in the United States except Pennsylvania anthracite. Tables 49 and 50 are upon the same basis but do not include consumer-operated plants. There are no mechanical cleaning plants at lignite mines.

Consumer-operated plants include plants owned by steel companies which receive coal from various mines (but usually from affiliated companies), clean it, and then consume it directly at the plant.

Table 46 compares bituminous coal cleaned in 1939–42, inclusive, by method of cleaning. Both wet and pneumatic methods increased in 1942 over 1941.

Mechanical cleaning, by types of equipment.—The tonnage of bituminous coal cleaned by wet-washing methods reached 121,999,858 net tons in 1942—an increase of 21 percent over 1941. The quantity cleaned by pneumatic methods was 20,187,488 net tons—an increase of 18 percent over 1941.

Table 47 compares the number of cleaning plants and the net tons of cleaned coal, by types of equipment, for 1941 and 1942. During 1942, 406 wet-washing and 84 pneumatic cleaning plants were in operation. Fifty-two tipples used both wet and dry methods at the same plant; deducting these duplications gives a net total of 438 plants that cleaned coal in 1942 compared with 417 in 1941.

Wet methods of cleaning coal include piston- or common-type jigs, Baum-type jigs, concentrating tables, launders and upward-current classifiers, and combinations of jigs with concentrating tables and jigs with launders or upward-current classifiers. Baum-type jigs cleaned approximately 42 percent of the coal cleaned by wet methods during 1942.

Pneumatic methods of coal cleaning include air tables, air flow, air sand, and any combinations of these three methods. During 1942, air tables cleaned 59 percent of the coal cleaned by pneumatic methods.

Table 48 lists the total production in 1941 and 1942 at bituminous-coal mines that have cleaning plants, by types of equipment. This table shows that 218,073,891 net tons were produced at mines with cleaning plants in 1942, but the cleaned coal obtained at these mines totaled 131,397,597 net tons (see table 52) or 60 percent of the total produced. The remainder of the output (40 percent) presumably represents the larger sizes, which are generally hand-picked.

Coal cleaning, by States.—In volume of total tonnage of bituminous coal mechanically cleaned in 1942, Pennsylvania led; West Virginia, Illinois, Alabama, and Indiana followed in the order named. These five States supplied 119,309,228 tons (84 percent) of the total. Table 50 shows the number of plants in operation, net tons of clean coal, and percentage of State output mechanically cleaned in 1941 and 1942. Table 51 shows similar data by Coal Act districts.

Relation between raw coal, clean coal, and refuse.—For every 100 tons of raw coal cleaned at the mines during 1942, 86.9 tons of clean merchantable coal, on an average, were obtained, and 13.1 tons of refuse were discarded. Tables 52 and 53 show total production of mines with cleaning plants and results of cleaning operations by States and Coal Act districts, respectively.

Methods of mining at mines served by cleaning plants.—Mechanical loading, both in underground mines and strip pits, appears to be closely related to mechanical cleaning. Table 49 shows the mining methods at mines that have cleaning plants. Production of coal from strip mines in 1942 was 67,202,663 tons (see table 44); 28,597,289 tons (43 percent) came from strip mines having mechanical cleaning tipples. 232,902,920 tons of underground coal were loaded mechanically in 1942, of which 118,917,178 tons (51 percent) passed through tipples equipped with mechanical cleaning devices. Hand-loaded underground coal production in 1942 totaled 282,587,354 tons, of which 25 percent passed through tipples equipped with cleaning plants.

TABLE 46.—*Bituminous coal mechanically cleaned by wet and pneumatic methods, in the United States, in net tons of clean coal, 1939–42*

Method of cleaning	1939	1940	1941	1942	Change, 1942 from 1941 (percent)
By wet methods:					
At mines	60,933,898	78,539,869	91,126,091	111,210,109	+22.0
At consumer-operated cleaning plants	6,800,587	8,750,220	9,251,543	10,789,749	+16.6
Total wet methods	67,734,485	87,290,089	100,377,634	121,999,858	+21.5
By pneumatic methods	11,694,941	14,979,664	17,161,888	20,187,488	+17.6
Grand total	79,429,426	102,269,753	117,539,522	142,187,346	+21.0

TABLE 47.—*Bituminous coal cleaned in the United States, by types of equipment in actual operation, 1941–42*

[Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania are included]

Type of equipment	Plants in operation		Net tons of clean coal		Percent cleaned by each type	
	1941	1942	1941	1942	1941	1942
Wet methods:						
Jigs	202	220	53,286,566	66,875,931	45.3	47.0
Concentrating tables	13	16	2,510,186	3,138,365	2.2	2.2
Jigs in combination with concentrating tables	20	15	4,364,220	4,366,100	3.7	3.1
Jigs in combination with launders and upward-current classifiers	11	14	5,446,245	5,594,983	4.6	3.9
Launders and upward-current classifiers	135	141	34,770,417	42,024,479	29.6	29.6
Total wet methods	381	406	100,377,634	121,999,858	85.4	85.8
Pneumatic methods	80	84	17,161,888	20,187,488	14.6	14.2
Grand total	[1] 461	[1] 490	117,539,522	142,187,346	100.0	100.0

[1] Plants using both wet and pneumatic methods totaled 44 in 1941 and 52 in 1942.

TABLE 48.—*Total production of all coal at bituminous mines in the United States having cleaning plants, in net tons, 1941–42*

[Does not include any estimate for mines that may ship to consumer-operated plants]

Type of equipment	1941	1942	Change, 1942 from 1941 (percent)
Wet methods:			
Jigs	85,752,968	103,929,379	+21.2
Concentrating tables	1,927,109	2,795,456	+45.1
Jigs in combination with concentrating tables	5,097,435	4,855,537	−4.7
Jigs in combination with launders and upward-current classifiers	8,325,444	8,948,388	+7.5
Launders and upward-current classifiers	69,351,140	82,712,948	+19.3
Total wet methods	170,454,096	203,241,708	+19.2
Pneumatic methods	45,471,216	53,367,701	+17.4
Grand total	215,925,312	256,609,409	+18.8
Less duplication [1]	30,457,143	38,535,518	+26.5
Net total	185,468,169	218,073,891	+17.6
United States total production [2]	514,149,245	582,692,937	+13.3
Percent produced at mines having cleaning plants	36.1	37.4	

[1] Mines using both wet and pneumatic methods.

[2] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania. There are no mechanical cleaning plants at lignite mines.

TABLE 49.—*Method of mining at bituminous-coal mines in the United States served by cleaning plants, 1939–42*

[Does not include any estimate for mines that may ship to consumer-operated plants]

Method of mining in use	Total production from mines that move coal to cleaning plants (net tons) [1]				Change, 1942 from 1941 (percent)
	1939	1940	1941	1942	
Mined from strip pits	17,960,049	20,029,770	24,773,543	28,597,289	+15.4
Mechanically loaded underground	53,495,851	66,148,465	93,373,789	118,917,178	+27.4
Hand-loaded underground	61,857,850	75,557,899	67,320,837	70,559,424	+4.8
Total	133,313,750	161,736,134	185,468,169	218,073,891	+17.6

[1] Based upon shipping weights and includes some marketable coal that did not pass through cleaning plants.

TABLE 50.—*Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by States, 1941–42*

[Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania are included]

State	Plants in operation		Net tons of clean coal		Percent of State output mechanically cleaned	
	1941	1942	1941	1942	1941	1942
Alabama	57	57	12,835,169	15,697,911	83.0	81.3
Alaska	1	1	69,665	73,417	29.2	28.1
Arkansas	2	2	(1)	(1)		
Colorado	10	9	1,216,128	1,157,313	17.5	14.3
Georgia	1	1	(1)	(1)		
Illinois	49	56	22,126,723	27,209,284	40.4	41.8
Indiana	19	17	7,205,041	9,082,500	32.0	35.8
Kansas	7	7	2,283,689	2,565,936	57.0	60.7
Kentucky	16	20	3,005,717	4,622,553	5.6	7.4
Michigan	1	1	(1)	(1)		
Missouri	11	10	1,517,861	1,487,060	48.3	42.2
Montana	1	3	(1)	(1)		
New Mexico	1	1	(1)	90,738		5.4
Ohio	10	10	4,626,146	6,022,900	15.8	18.4
Pennsylvania [2]	57	62	29,948,020	35,712,262	23.0	24.8
Tennessee	5	6	337,159	455,413	4.8	5.6
Utah	3	3	1,042,679	1,413,048	25.6	25.6
Virginia	22	22	2,733,166	3,062,674	14.8	15.2
Washington	21	21	1,632,427	1,726,599	88.7	88.4
West Virginia [3]	123	129	26,724,333	31,607,271	19.1	20.3
Undistributed:						
East of Mississippi River			58,661	48,114		
West of Mississippi River			176,938	152,353		
Total	[4] 417	[5] 438	117,539,522	142,187,346	22.9	24.4

[1] Included in "Undistributed."

[2] Includes some coal mined in Pennsylvania and cleaned in Ohio and a small tonnage mined in West Virginia and cleaned at a consumer-operated plant in Pennsylvania.

[3] Includes some coal mined in West Virginia and cleaned in Ohio.

[4] Represents 44 plants using both wet and pneumatic methods of cleaning plus 373 plants using only 1 cleaning method.

[5] Represents 52 plants using both wet and pneumatic methods of cleaning plus 386 plants using only 1 cleaning method.

TABLE 51.—*Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by districts, 1941–42*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto. Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania are included]

Minimum price area and producing district	Plants in operation		Net tons of clean coal		Percent of district output mechanically cleaned	
	1941	1942	1941	1942	1941	1942
PRICE AREA 1						
Dist. 1. Eastern Pennsylvania [1]	28	29	11,242,229	13,369,376	21.6	23.0
Dist. 2. Western Pennsylvania [2]	29	33	18,705,791	22,342,886	23.1	25.1
Dist. 3. Northern West Virginia	6	7	2,808,109	3,507,414	8.7	9.0
Dist. 4. Ohio	10	10	4,626,146	6,022,900	15.8	18.4
Dist. 5. Michigan	1	1	(3)	(3)		
Dist. 6. Panhandle	1	2	(3)	354,296		6.4
Dist. 7. Southern numbered 1	92	95	13,021,338	16,598,166	21.7	25.6
Dist. 8. Southern numbered 2 [4]	59	64	14,741,528	17,144,825	13.6	14.1
Total, price area 1	226	241	[5] 65,145,141	[5] 79,249,863	[5] 17.7	[5] 19.3

See footnotes at end of table.

TABLE 51.—*Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by Districts, 1941–42*—Continued

Minimum price area and producing district	Plants in operation		Net tons of clean coal		Percent of district output mechanically cleaned	
	1941	1942	1941	1942	1941	1942
PRICE AREA 2						
Dist. 9. Western Kentucky	5	5	1,738,117	1,943,487	15.0	14.5
Dist. 10. Illinois	49	56	22,126,723	27,209,284	40.4	41.8
Dist. 11. Indiana	19	17	7,205,041	9,082,500	32.0	35.8
Dist. 12. Iowa	......	......	......	......	......	......
Total, price area 2	73	78	31,069,881	38,235,271	33.9	35.8
PRICE AREA 3						
Dist. 13. Southeastern	61	62	13,048,869	16,005,202	78.0	76.7
PRICE AREA 4						
Dist. 14. Arkansas-Oklahoma	2	2	(3)	(3)	......	......
PRICE AREA 5						
Dist. 15. Southwestern:						
Bituminous	18	17	3,801,550	4,052,996	44.9	42.1
Lignite (Texas)	......	......	......	......	......	......
Total, price area 5	18	17	3,801,550	4,052,996	42.9	40.6
PRICE AREA 6						
Dist. 16. Northern Colorado	......	......	......	......	......	......
Dist. 17. Southern Colorado [6]	11	10	(3)	1,248,051	......	19.8
Dist. 18. New Mexico [7]	......	......	......	......	......	......
Total, price area 6	11	10	(3)	1,248,051	......	12.8
PRICE AREA 7						
Dist. 19. Wyoming [8]	......	......	......	......	......	......
Dist. 20. Utah	3	3	1,042,679	1,413,048	25.6	25.6
Total, price area 7	3	3	1,042,679	1,413,048	9.7	10.4
PRICE AREA 8						
Dist. 21. North-South Dakota (lignite)	......	......	......	......	......	......
PRICE AREA 9						
Dist. 22. Montana (bituminous)	1	3	(3)	(3)	......	......
PRICE AREA 10						
Dist. 23. Washington [9]	21	21	1,632,427	1,726,599	88.6	88.3
Alaska	1	1	69,665	73,417	29.2	28.1
Total, price area 10	22	22	1,702,092	1,800,016	81.7	81.2
Undistributed	......	......	1,729,310	182,899	......	......
Grand total [10]	[11] 417	[12] 438	117,539,522	142,187,346	22.9	24.4

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[1] Includes Maryland and Grant, Mineral, and Tucker Counties, W. Va.

[2] Includes some coal mined in Pennsylvania and cleaned in Ohio and a small tonnage mined in West Virginia and cleaned at a consumer-operated plant in Pennsylvania.

[3] Included under "Undistributed."

[4] Includes some coal mined in West Virginia and cleaned in Ohio.

[5] Incomplete. Part of total included under "Undistributed."

[6] Includes Colfax County, N. Mex.

[7] Includes Arizona and California, but excludes Colfax County, N. Mex.

[8] Includes Idaho.

[9] Includes Oregon.

[10] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania. There are no mechanical cleaning plants at lignite mines.

[11] Represents 44 plants using both wet and pneumatic methods of cleaning plus 373 plants using only 1 cleaning method.

[12] Represents 52 plants using both wet and pneumatic methods of cleaning plus 386 plants using only 1 cleaning method.

TABLE 52.—*Result of operations at bituminous-coal cleaning plants in the United States, by States, in net tons, in 1942*

State	Total raw coal moved to cleaning plants	Coal obtained in cleaning process	Refuse resulting in cleaning process	Percent of refuse to raw coal	Total production from mines that moved coal to cleaning plants[1]
Alabama	18,266,496	15,697,911	2,568,585	14.1	16,660,700
Alaska	105,657	73,417	32,240	30.5	73,417
Colorado	(2)	(2)	(2)	6.2	(2)
Georgia	23,035	17,568	5,467	23.7	30,913
Illinois	32,247,113	27,209,284	5,037,829	15.6	42,011,823
Indiana	10,646,042	9,082,500	1,563,542	14.7	13,279,512
Kansas	3,158,645	2,565,936	592,709	18.8	2,571,208
Kentucky	5,116,866	4,622,553	494,313	9.7	10,159,394
Missouri	1,899,212	1,487,060	412,152	21.7	2,131,414
New Mexico	97,540	90,738	6,802	7.0	382,922
Ohio	7,766,548	6,022,900	1,743,648	22.5	7,754,446
Pennsylvania[3]	(2)	(2)	(2)	9.7	(2)
Tennessee	500,663	455,413	45,250	9.0	1,488,219
Utah	1,509,609	1,413,048	96,561	6.4	2,461,736
Virginia	3,332,683	3,062,674	270,009	8.1	10,695,251
Washington	2,003,754	1,726,599	277,155	13.8	1,875,274
West Virginia[4]	35,459,673	31,607,271	3,852,402	10.9	66,736,725
Other States[5]	29,078,971	26,262,725	2,816,246		39,760,937
Total at mines only[6]	151,212,507	131,397,597	19,814,910	13.1	218,073,891
Consumer plants[7]	11,386,033	10,789,749	596,284	5.2	
Grand total	162,598,540	142,187,346	20,411,194	12.6	

[1] Based upon shipping weights, and includes some marketable coal that did not pass through cleaning plants.

[2] Included with "Other States."

[3] Includes some coal that was mined in Pennsylvania and cleaned in Ohio.

[4] Includes some coal that was mined in West Virginia and cleaned in Ohio.

[5] Includes Arkansas, Colorado, Michigan, Montana, and Pennsylvania.

[6] Includes all mechanical cleaning other than washeries operated by consumer steel companies.

[7] Includes central washeries in Colorado and Pennsylvania operated by consumer steel companies.

TABLE 53.—*Result of operations at bituminous-coal-cleaning plants in the United States, by districts, in net tons, in 1942*

[Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto]

Minimum price area and producing district	Total raw coal moved to cleaning plants	Coal obtained in cleaning process	Refuse resulting in cleaning process	Percent of refuse to raw coal	Total production from mines that moved coal to cleaning plants[1]
PRICE AREA 1					
Dist. 1. Eastern Pennsylvania[2]	(3)	(3)	(3)	(3)	(3)
Dist. 2. Western Pennsylvania[4]	(3)	(3)	(3)	(3)	(3)
Dist. 3. Northern West Virginia	3,813,672	3,507,414	306,258	8.0	5,515,530
Dist. 4. Ohio	7,766,548	6,022,900	1,743,648	22.5	7,754,446
Dist. 5. Michigan	(3)	(3)	(3)	(3)	(3)
Dist. 6. Panhandle	382,795	354,296	28,499	7.4	887,937
Dist. 7. Southern numbered 1	18,511,927	16,508,166	2,003,761	10.8	45,948,635
Dist. 8. Southern numbered 2[5]	19,266,142	17,144,825	2,121,317	11.0	32,649,778
Total, price area 1	[6] 49,741,084	[6] 43,537,601	[6] 6,203,483	[6] 12.5	[6] 92,756,326
PRICE AREA 2					
Dist. 9. Western Kentucky	2,114,017	1,943,487	170,530	8.1	3,069,935
Dist. 10. Illinois	32,247,113	27,209,284	5,037,829	15.6	42,011,823
Dist. 11. Indiana	10,646,042	9,082,500	1,563,542	14.7	13,279,512
Dist. 12. Iowa					
Total, price area 2	45,007,172	38,235,271	6,771,901	15.0	58,361,270
PRICE AREA 3					
Dist. 13. Southeastern	18,610,863	16,005,202	2,605,661	14.0	17,699,387

See footnotes at end of table.

TABLE 53.—*Result of operations at bituminous-coal-cleaning plants in the United States by districts, in net tons, in 1942*—Continued

Minimum price area and producing district	Total raw coal moved to cleaning plants	Coal obtained in cleaning process	Refuse resulting in cleaning process	Percent of refuse to raw coal	Total production from mines that moved coal to cleaning plants [1]
PRICE AREA 4					
Dist. 14. Arkansas-Oklahoma	(3)	(3)	(3)	(3)	(3)
PRICE AREA 5					
Dist. 15. Southwestern:					
Bituminous	5,057,857	4,052,996	1,004,861	19.9	4,702,622
Lignite (Texas)	-------	-------	-------	-------	-------
Total, price area 5	5,057,857	4,052,996	1,004,861	19.9	4,702,622
PRICE AREA 6					
Dist. 16. Northern Colorado	-------	-------	-------	-------	-------
Dist. 17. Southern Colorado [7]	(3)	(3)	(3)	(3)	(3)
Dist. 18. New Mexico [8]	-------	-------	-------	-------	-------
Total, price area 6	(3)	(3)	(3)	(3)	(3)
PRICE AREA 7					
Dist. 19. Wyoming [9]	-------	-------	-------	-------	-------
Dist. 20. Utah	1,509,609	1,413,048	96,561	6.4	2,461,736
Total, price area 7	1,509,609	1,413,048	96,561	6.4	2,461,736
PRICE AREA 8					
Dist. 21. North-South Dakota (lignite)	-------	-------	-------	-------	-------
PRICE AREA 9					
Dist. 22. Montana (bituminous)	(3)	(3)	(3)	(3)	(3)
PRICE AREA 10					
Dist. 23. Washington [10]	2,003,754	1,726,599	277,155	13.8	1,875,274
Alaska	105.657	73,417	32,240	30.5	73,417
Total, price area 10	2,109,411	1,800,016	309,395	14.7	1,948,691
Undistributed	29,176,511	26,353,463	2,823,048	9.7	40,143,859
Total at mines only [11]	151,212,507	131,397,597	19,814,910	13.1	218,073,891
Consumer plants [12]	11,386,033	10,789,749	596,284	5.2	-------
Grand total [13]	162,598,540	142,187,346	20,411,194	12.6	-------

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[1] Based upon shipping weights, and includes some marketable coal that did not pass through cleaning plants.

[2] Includes Maryland, and Grant, Mineral, and Tucker Counties, W. Va.

[3] Included under "Undistributed."

[4] Includes some coal that was mined in Pennsylvania and cleaned in Ohio.

[5] Includes some coal that was mined in West Virginia and cleaned in Ohio.

[6] Incomplete. Part of total included under "Undistributed"

[7] Includes Colfax County, N. Mex.

[8] Includes Arizona and California, but excludes Colfax County, N. Mex.

[9] Includes Idaho.

[10] Includes Oregon.

[11] Includes all mechanical cleaning other than washeries operated by consumer steel companies.

[12] Includes central washeries in Colorado and Pennsylvania operated by consumer steel companies.

[13] For purposes of historical comparison and statistical convenience, the figures include the output of lignite and of anthracite and semianthracite outside of Pennsylvania. There are no mechanical cleaning plants at lignite mines.

DETAILED STATISTICS, BY STATES AND COUNTIES

Detailed production and employment statistics are given in table 54 for each coal-producing county in the United States from which three or more operators submitted reports for 1942. Statistics on counties with less than three reporting producers have been combined with data for other counties in the same State to avoid disclosing individual returns, unless permission to publish has been granted by the operators. Production of mines on the border between two States has been credited to the State from which the coal is extracted rather than that in which the tipple is situated. If the coal is mined from lands in both States, the tonnage has been apportioned accordingly.

In this series the reported production is classified according to the principal methods of distribution or use. Beginning with 1932, the series was expanded to include data on the growing volume of coal moving from mine to consumer by truck. For 1933–36 this tonnage was shown as "commercial sales by truck or wagon." In 1937 this tonnage was shown as "truck deliveries, including local sales." (See Minerals Yearbook, 1939, p. 813.) In 1938 the truck tonnage was shown as "shipped by truck or wagon." The truck figures for 1933 to 1936, inclusive, and 1938 to 1942, inclusive, are reasonably comparable.

The data in this report, like those published for many years by the Bureau of Mines, relate only to mines with an annual output of 1,000 tons or more. This fact should be borne in mind when the statistics in this report are compared with similar data compiled by State mine departments. Differences arise largely from variations in coverage of the State reports, some of which include data for all mines, regardless of size, and others only data for mines employing more than a specified minimum number, which ranges from 2 to 10 men. To meet the administrative demand for statistics on mines with an annual output of less than 1,000 tons per year, data are shown for the small mines in table 55. The production in table 55 is not included in the total output for the United States as this would upset the comparability of the statistical series.

Because of a change in the method of reporting, the statistics of average production per man per day for 1932 to 1936 and 1938 to 1941 are not precisely comparable with those for earlier years. Before 1932 they were based upon the calculated number of man-shifts, obtained by multiplying the average number of men employed at each mine by the number of days worked at the mine. Since 1932 operators have been asked to make a special report of the number of man-shifts actually worked, if possible. The number of operators able to furnish this information has been small, although it is increasing from year to year. These reports were utilized to improve the accuracy of the record. Otherwise, the man-shifts were calculated by multiplying the number employed underground and on the surface by the number of days worked by the mine and tipple, respectively.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
ALABAMA													
Bibb	790,969	22,477	4,238	17,592	835,276	$3.32	1,177		197	1,374	260	357,520	2.34
Blount	43,790	79,915	285	720	124,710	2.75	152	43	48	243	218	53,093	2.35
Cullman		46,670	30	25	46,725	3.25	94		25	119	226	26,844	1.74
Etowah	1,264	23,071			24,335	2.76	51		13	64	164	10,476	2.32
Jefferson	10,123,766	355,662	68,990	[4] 59,843	10,608,261	2.88	12,698	9	1,916	14,623	274	4,009,796	2.65
Madison		1,006	10		1,016	3.65	2		1	3	208	624	1.63
Marion	270,856	117,081	1,528		389,465	3.84	562	4	125	691	230	159,048	2.45
St. Clair	1,111,890	41,133	15,312	39,851	1,208,186	2.80	1,440		190	1,630	242	393,767	3.07
Shelby	495,246	110,157	3,006	1,513	609,922	3.60	927		178	1,105	230	253,613	2.40
Tuscaloosa	226,397	72,353	1,416		300,166	2.55	442		124	566	221	124,836	2.40
Walker	4,425,205	333,166	321,884	2,549	5,082,804	2.64	4,694	139	747	5,580	255	1,424,210	3.57
Winston	2,543	19,952			22,495	2.75	52		12	64	173	11,060	2.03
Other counties (Cherokee and Jackson)	4,414	43,479			47,893	3.10	70		21	91	247	22,432	2.14
Total Alabama	17,496,340	1,266,122	416,699	[4] 122,093	19,301,254	2.87	22,361	195	3,597	26,153	262	6,847,319	2.82
ALASKA													
Total Alaska	242,725	8,553		[5] 9,615	260,893	$6.22	183		65	248	299	74,064	3.52

Johnson	273, 123	28, 579	688	1, 996	304, 386	$3. 36	433	42	126	601	158	95, 002	3. 20
Logan	561, 416	3, 603	5, 384	2, 277	572, 680	4. 68	969		195	1, 164	204	238, 010	2. 41
Sebastian	895, 685	57, 703	1, 015	1, 897	956, 300	3. 44	1, 095	49	192	1, 336	207	276, 357	3. 46
Other counties (Franklin and Pope)	137, 583	12, 515	48	1, 881	152, 027	3. 66	230	12	50	292	188	55, 008	2. 76
Total Arkansas	1, 867, 807	102, 400	7, 135	[5] 8, 051	1, 985, 393	3. 80	2, 727	103	563	3, 393	196	664, 377	2. 99
ARIZONA													
Total Arizona		10, 991	382		11, 373	$2. 64	26		3	29	191	5, 534	2. 06
COLORADO													
Boulder	297, 449	400, 607	7, 027	6, 237	711, 320	$3. 06	552		103	655	256	167, 724	4. 24
Delta	63, 948	25, 976	483	4, 255	94, 662	2. 75	60		23	83	250	20, 746	4. 56
El Paso	29, 663	176, 720	33, 554	8, 554	248, 491	2. 97	153		28	181	291	52, 624	4. 72
Fremont	162, 838	370, 390	5, 012	1, 951	540, 191	3. 22	597		132	729	204	148, 529	3. 64
Garfield	7, 918	44, 470		1, 380	53, 768	3. 07	38		12	50	276	13, 785	3. 90
Gunnison	728, 205	21, 541	9, 748	14, 864	774, 358	2. 63	454		132	586	261	152, 893	5. 06
Huerfano	915, 267	61, 462	4, 315	1, 771	982, 815	2. 99	804		186	990	245	242, 511	4. 05
Jefferson	110, 150	34, 832	1, 261	814	147, 057	2. 43	100		22	122	221	26, 945	5. 46
La Plata	18, 643	24, 513	348	30	43, 534	2. 46	49		9	58	243	14, 098	3. 09
Las Animas	1, 242, 540	52, 724	7, 744	[6] 154, 310	1, 457, 318	2. 74	1, 592		258	1, 850	251	464, 083	3. 14
Mesa	78, 820	33, 103	595	6, 111	118, 629	2. 56	106		23	129	235	30, 251	3. 92
Moffatt	41, 190	17, 697	6, 930		65, 817	3. 07	20		14	34	256	8, 696	7. 57
Montrose		37, 797	7, 905		45, 702	3. 44	44		6	50	303	15, 162	3. 01
Routt	1, 104, 787	20, 010	17, 047	44, 062	1, 185, 906	3. 27	785		262	1, 047	243	254, 394	4. 66
Weld	1, 212, 140	335, 654	11, 887	25, 478	1, 585, 159	2. 54	894		205	1, 099	228	250, 938	6. 32
Other counties:													
Elbert and Jackson	5, 106	10, 250		533	15, 889	2. 95	7	9	4	20	265	5, 295	3. 00
Montezuma and Rio Blanco		14, 901	127	36	15, 064	3. 22	17		5	22	248	5, 462	2. 76
Total Colorado	6, 018, 664	1, 682, 647	113, 983	[6] 270, 386	8, 085, 680	2. 86	6, 272	9	1, 424	7, 705	243	1, 874, 136	4. 31
GEORGIA													
Total Georgia	28, 814	215	804	[6] 1, 080	30, 913	$3. 28	71		41	112	252	28, 224	1. 10

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
ILLINOIS													
Bureau	190	88,066	2,103	2,954	93,313	$3.17	125	19	21	165	156	25,748	3.62
Christian	5,921,844	140,905	526	23,865	6,087,140	1.58	1,791		501	2,292	252	577,609	10.54
Clinton	175,831	98,247	3,144	10,353	287,575	1.76	279		49	328	182	59,582	4.83
Edgar		33,083	235	2,920	36,238	2.36	48		7	55	156	8,604	4.21
Franklin	13,154,785	123,627	135,351	199,245	13,613,008	2.05	4,991		1,500	6,491	233	1,512,258	9.00
Fulton	5,879,117	474,382	9,257	13,242	6,375,998	1.77	575	433	719	1,727	224	386,494	16.50
Gallatin	3,656	62,113	24	3,709	69,502	1.90	69		17	86	233	20,070	3.46
Grundy		73,968	1,026	1,215	76,209	3.51	44	19	12	75	189	14,195	5.37
Hancock		15,632			15,632	2.57		10	11	21	74	1,560	10.02
Henry	579,684	131,165	859	377	712,085	2.13	123	83	99	305	260	79,428	8.97
Jackson	2,399,552	114,126	6,992	4,868	2,525,538	1.80	694	69	188	951	259	246,561	10.24
Knox	687,661	206,976	2,285	2,912	899,834	2.15	190	60	91	341	246	83,989	10.71
La Salle	90,324	276,641	16,118	590	383,673	3.19	383	57	74	514	193	99,442	3.86
Livingston		5,018	65	247	5,330	3.61	18	4	3	25	156	3,905	1.36
McDonough		6,765			6,765	2.84	3	7	1	11	172	1,888	3.58
Macon		7,000	171	632	7,803	3.12	74		6	80	40	3,200	2.44
Macoupin	4,360,901	240,143	25,242	140,419	4,766,705	1.56	2,022		464	2,486	246	612,117	7.79
Madison	1,039,646	868,255	19,346	77,343	2,004,590	1.87	1,158		260	1,418	229	325,062	6.17
Menard		106,173	255	3,488	109,916	2.39	122		20	142	221	31,315	3.51
Mercer		13,057	298	72	13,427	3.51	21		5	26	214	5,555	2.42
Montgomery	748,974	30,428	2,702	45,700	827,804	1.60	210		81	291	266	77,406	10.69
Peoria	351,712	521,711	5,523	1,412	880,358	2.22	756		89	845	212	178,873	4.92
Perry	4,078,428	117,441	8,207	59,667	4,263,743	1.74	771	330	581	1,682	235	394,441	10.81
Randolph	1,880,226	89,114	4,602	32,648	2,006,590	1.70	454	51	244	749	233	174,646	11.49
Rock Island		9,128	13		9,141	3.26	27		5	32	101	3,229	2.83
St. Clair	1,159,843	1,289,070	138,155	57,764	2,644,832	1.77	1,273	107	334	1,714	188	322,985	8.19
Saline	4,966,727	72,722	8,435	45,963	5,093,847	2.20	1,803	149	556	2,508	217	543,988	9.36
Sangamon	2,606,718	658,547	6,667	24,173	3,296,105	1.95	2,411		336	2,747	222	609,345	5.41

ILLINOIS—Continued

Schuyler	63,634	68,291	1,941	211	134,077	2.08	51	13	29	93	193	17,979	7.46
Shelby		6,275		26	6,301	3.92	18		4	22	233	5,134	1.23
Stark		7,506	10	16	7,532	$2.91	14		4	18	214	3,856	1.95
Vermilion	1,848,477	455,415	16,730	11,933	2,332,555	2.10	1,681	33	229	1,943	210	407,761	5.72
Warren		12,014			12,014	1.79	10		2	12	270	3,240	3.71
Washington	285,454	60,646	2,321	13,874	362,295	1.81	226		59	285	181	51,678	7.01
Williamson	2,074,696	668,966	25,332	50,727	2,819,721	1.95	1,227	39	346	1,612	225	362,629	7.78
Woodford	2,601	30,771	1,267	4,695	39,334	4.18	102		11	113	163	18,419	2.14
Other counties [7]	1,643,127	548,787	10,349	42,026	2,244,289	2.26	532	291	355	1,178	235	276,308	8.12
Total Illinois	56,003,808	7,732,174	455,551	[8] 879,286	65,070,819	1.91	24,296	1,774	7,313	33,383	226	7,550,499	[8] 8.62

INDIANA

Clay	1,655,449	462,192	1,348	10,958	2,129,947	$2.12	111	412	303	826	232	191,226	11.14
Daviess	2,526	120,256	536	412	123,730	2.41	79	15	27	121	235	28,381	4.36
Dubois		14,897	50		14,947	1.98	10	3	4	17	221	3,764	3.97
Fountain	9,341	77,483	20	87	86,931	2.50	5	28	14	47	179	8,414	10.33
Gibson	997,317	187,051	218	27,801	1,212,387	2.02	509		100	609	220	133,941	9.05
Greene	2,826,998	78,716	791	19,385	2,925,890	1.80	359	368	356	1,083	250	270,845	10.80
Knox	2,682,236	429,122	8,135	23,364	3,142,857	1.76	1,157	19	298	1,474	248	365,625	8.60
Owen	34,599	8,720			43,319	2.02		18	16	34	100	3,390	12.78
Parke		118,600	118	3,826	122,544	2.58	151		28	179	229	41,011	2.99
Perry		45,248	77	29	45,354	2.06	52		10	62	245	15,210	2.98
Pike	4,339,563	58,163	15,739	13,035	4,426,500	1.55	44	468	472	984	243	239,366	18.49
Spencer	74,448	47,076	48	53	121,625	2.64	34	43	34	111	206	22,908	5.31
Sullivan	1,911,020	157,059	4,411	21,998	2,094,488	2.05	873	155	301	1,329	198	263,609	7.95
Vermillion	396,784	97,152	2,588	4,614	501,138	1.78	233	80	165	478	119	56,709	8.84
Vigo	3,567,344	339,425	405,093	17,621	4,329,483	1.77	1,294	196	406	1,896	226	427,636	10.12
Warrick	3,621,950	329,273	4,011	5,287	3,960,521	1.59	365	228	424	1,017	272	276,573	14.32
Other counties (Martin and Vanderburgh)	53,680	52,500		210	106,390	1.62	87		46	133	173	22,989	4.63
Total Indiana	22,173,255	2,622,933	443,183	[8] 148,680	25,388,051	1.78	5,363	2,033	3,004	10,400	228	2,371,647	[8] 10.70

IOWA

Adams		12,306	80	50	12,436	$3.82	43		9	52	192	10,000	1.24
Appanoose	279,161	172,934	4,252	801	457,148	2.87	1,000		116	1,116	162	180,587	2.53
Boone	160,092	65,033	5,928	1,797	232,850	3.48	375	4	43	422	205	86,326	2.70
Jasper	111	63,826	785	134	64,856	2.99	61	12	14	87	208	18,131	3.58
Lucas	72,751	29,939	1,964	221	104,875	2.73	169		18	187	145	27,124	3.87
Mahaska	190,929	138,548	341	991	330,809	2.62	28	108	65	201	174	35,028	9.44
Marion	183,772	324,745	1,540	3,981	514,038	2.36	296	102	92	490	210	102,997	4.99
Monroe	150,110	78,524	2,832	3,598	235,064	2.42	236	4	40	280	213	59,585	3.95
Page		29,462	38	20	29,520	4.02	68		6	74	247	18,242	1.62

See footnotes at end of table.

Table 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
IOWA—Continued													
Polk	76,160	224,112	6,354	1,187	307,813	3.26	440		37	477	195	93,050	3.31
Taylor	144	10,119			10,263	4.04	23		2	25	262	6,550	1.57
Van Buren		33,822	364	103	34,289	2.51	20	21	14	55	210	11,564	2.97
Wapello	27,135	158,817	1,076	1,391	188,419	2.80	144	36	39	219	221	48,432	3.89
Warren		16,069	185	162	16,416	2.99	80		20	100	59	5,924	2.77
Wayne		18,459	415	130	19,004	2.95	38		5	43	190	8,190	2.32
Webster	18,650	19,830	467	288	39,235	3.12	40		10	50	212	10,600	3.70
Other counties (Dallas, Davis, Greene, Guthrie, and Keokuk)	221,166	123,824	4,676	1,021	350,687	3.14	405	7	51	463	211	97,820	3.59
Total Iowa	1,380,181	1,520,369	31,297	[4] 15,875	2,947,722	2.85	3,466	294	581	4,341	189	820,150	3.59
KANSAS													
Bourbon	183,765	23,009	170	1,649	208,593	$2.17		47	20	67	227	15,210	13.71
Cherokee	1,167,301	77,667	2,272	3,013	1,250,253	2.24	26	142	183	351	253	88,687	14.10
Crawford	1,730,150	140,704	4,421	5,194	1,880,469	2.18	505	340	203	1,048	226	236,798	7.94
Franklin		16,277			16,277	3.78	28		7	35	219	7,672	2.12
Linn	708,142	21,027	640	173	729,982	1.96	35	59	77	171	249	42,630	17.12
Osage	660	81,336	937		82,933	3.69	250	3	30	283	184	52,103	1.59
Other counties (La Bette, Leavenworth, and Wilson)	46,586	14,315		450	61,351	2.10	406	19	83	508	288	146,398	.42
Total Kansas [9]	3,836,604	374,335	8,440	[4] 10,479	4,229,858	2.19	1,250	610	603	2,463	239	589,498	[10] 7.18

KENTUCKY

Eastern district:													
Bell	2,977,718	139,137	16,149	2,538	3,135,542	$2.57	3,366		454	3,820	240	915,407	3.43
Boyd		117,626	100	25	117,751	2.36	231		47	278	237	65,855	1.79
Breathitt	8,294	7,680	54,937		70,911	2.39	115		19	134	233	31,224	2.27
Carter	54,368	104,369	30	3,022	161,789	2.47	149		56	205	249	50,945	3.18
Clay	227,373	90,692	138	12	318,215	2.44	536		111	647	224	144,896	2.20
Clinton		3,705	25		3,730	2.58	12		4	16	115	1,840	2.03
Elliott		1,110			1,110	2.50	2		1	3	120	360	3.08
Floyd	6,409,224	18,703	12,699	20,457	6,461,083	2.63	5,281		1,074	6,355	216	1,372,762	4.71
Greenup		1,040			1,040	2.19	2			2	200	400	2.60
Harlan	14,910,118	54,799	83,648	11,443	15,060,008	2.68	13,031		1,923	14,954	251	3,758,790	4.01
Jackson		292,436	40	[11] 6,689	299,165	2.20	488		105	593	246	145,685	2.05
Johnson	660,659	2,985	4,377	1,520	669,541	2.94	683		103	786	231	181,418	3.69
Knott	587,651	9,752	2,415		599,818	2.38	412		81	493	235	115,841	5.18
Knox	705,528	84,197	4,531		794,256	2.52	830		150	980	238	233,141	3.41
Laurel	41,015	195,003	176	521	236,715	2.12	224	22	95	341	208	70,947	3.34
Lawrence	8,276	24,475	324	414	33,489	2.67	58		19	77	214	16,471	2.03
Lee	8,381	27,700			36,081	2.25	61		14	75	243	18,192	1.98
Leslie	140,108	1,716		50	141,874	2.37	147		40	187	187	34,973	4.06
Letcher	5,279,546	46,657	26,920	6,262	5,359,385	2.52	4,577		592	5,169	238	1,229,917	4.36
McCreary	922,625	18,232	7,846		948,703	2.45	895		118	1,013	250	253,592	3.74
Magoffin	96,850	5,552	20		102,422	2.36	114		12	126	211	26,559	3.86
Martin	371,141	2,654	742		374,537	2.24	230		46	276	227	62,718	5.97
Menefee		4,936	44		4,980	2.38	10		4	14	248	3,466	1.44
Morgan	1,643	6,877			8,520	2.50	22		4	26	218	5,658	1.51
Owsley		1,400			1,400	2.39	3		1	4	160	640	2.19
Perry	6,140,366	11,764	128,481	230	6,280,841	2.51	4,949		713	5,662	240	1,358,353	4.62
Pike	6,641,815	104,876	256,135	9,200	7,012,026	2.25	5,843		1,067	6,910	228	1,577,633	4.44
Pulaski		95,639			95,639	2.51	127		45	172	237	40,735	2.35
Rockcastle		19,849			19,849	2.35	42		18	60	207	12,394	1.60
Whitley	396,436	36,566	2,054	8,130	443,186	2.68	687	27	110	824	193	159,185	2.78
Wolfe		6,111	25		6,136	2.17	12		2	14	255	3,567	1.72
Total eastern Kentucky	46,589,135	1,538,238	601,856	[11] 70,513	48,799,742	2.54	43,139	49	7,028	50,216	237	11,893,564	4.10
Western district:													
Butler	1,000	46,957	20		47,977	2.04	69		24	93	208	19,305	2.49
Christian	42,539	26,387	53	1,804	70,783	1.79	72	33	20	125	161	20,074	3.53
Daviess	1,985	176,170	318	844	179,317	1.54	171		55	226	208	47,120	3.81
Edmonson		3,123			3,123	2.04	5		3	8	193	1,546	2.02
Hancock		19,409	34		19,443	1.86	28		7	35	205	7,191	2.70
Henderson	9,044	137,834	577	6,408	153,863	1.71	152		42	194	230	44,715	3.44
Hopkins	6,173,338	305,578	44,170	9,015	6,532,101	1.73	2,530	114	795	3,439	232	799,348	8.17
McLean	2,682	9,375	616		12,673	1.39	21		6	27	171	4,616	2.75
Muhlenberg	4,169,380	199,873	12,273	49,064	4,430,590	1.65	2,368	13	549	2,930	230	672,504	6.59
Ohio	177,793	87,070	134	2,306	267,303	1.61	257	6	76	339	182	61,865	4.32
Union	538,254	150,594	8,109	16,340	713,297	1.72	766		134	900	199	179,084	3.98
Webster	959,468	33,625		7,461	1,000,554	1.68	727		153	880	235	207,031	4.83
Total western Kentucky	12,075,483	1,195,995	66,304	93,242	13,431,024	1.70	7,166	166	1,864	9,196	224	2,064,399	6.51
Total Kentucky	58,664,618	2,734,233	668,160	[11] 163,755	62,230,766	2.36	50,305	215	8,892	59,412	235	13,957,963	4.46

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
MARYLAND													
Allegany	885,158	272,275	7,424	838	1,165,695	$2.66	1,263	16	178	1,457	252	366,894	3.18
Garrett	747,238	81,607	2,415	3,979	835,239	2.52	830		110	940	235	220,457	3.79
Total Maryland	1,632,396	353,882	9,839	[4] 4,817	2,000,934	2.60	2,093	16	288	2,397	245	587,351	3.41
MICHIGAN													
Shiawassee		18,489	499	51	19,039	$4.62	36		5	41	188	7,708	2.47
Other counties (Bay, Saginaw, and Tuscola)	69,930	127,983	4,894	9,302	212,109	4.40	298		46	339	248	84,149	2.52
Total Michigan	69,930	146,472	5,393	[5] 9,353	231,148	4.42	329		51	380	242	91,857	2.52
MISSOURI													
Adair	43,370	116,223	1,005	3,340	163,938	$2.37	210		33	243	230	55,942	2.9
Barton	214,072	20,823	383	450	235,728	2.26	9	49	25	83	230	19,056	[10] 12.33
Bates	106,959	25,379	170	3,390	135,898	2.20	13	79	59	151	110	16,671	[10] 8.14
Boone		39,045	76	172	39,293	2.48	16	26	12	54	224	12,114	3.2

MISSOURI—Continued

Calloway		191,737	90	408	192,235	$ 2.35	4	70	12	86	293	25,229	[10] 7.62
Carroll		1,238			1,238	3.00		5		5	148	740	1.67
Chariton		4,100			4,100	2.55	12		2	14	245	3,430	1.20
Clay		126,619	2,548	2,351	131,518	3.45	305		30	335	215	72,189	1.82
Dade		13,339			13,339	2.85		14	3	17	231	3,920	3.40
Daviess		22,071		497	22,568	3.41	46		4	50	248	12,400	1.82
Henry	360,947	101,638	280	5,192	468,057	2.10	39	95	59	193	242	46,694	[10] 10.02
Jasper		9,406		993	10,399	2.60		7	2	9	294	2,646	3.93
Johnson	202,635	15,683	125	25	218,468	2.31		66	15	81	221	17,890	[10] 12.21
Lafayette	138,284	110,133	6,957	3,005	258,379	2.99	551		58	609	213	129,520	1.99
Lincoln		1,015	1		1,016	3.00		2		2	64	128	7.94
Linn	7,871	66,411	528		74,810	2.89	155		16	171	279	47,637	1.57
Macon	509,553	64,757	541	243	575,094	2.01	96	70	68	234	246	57,536	[10] 10.00
Putnam		47,590	200	35	47,825	2.52	96		19	115	209	24,075	1.99
Ralls		10,867	50		10,917	2.80	12	6	4	22	198	4,350	2.51
Randolph	490,617	127,548	700	350	619,215	2.18	201	44	91	336	253	84,842	[10] 7.30
Ray	14,138	137,073	1,567	256	153,034	3.44	457		48	505	163	82,101	1.86
Vernon	53,897	42,974	792	3,534	101,197	1.98	10	78	15	103	171	17,618	[10] 5.74
Other counties (Clark, Grundy, Harrison, Monroe, and St. Clair)	1,404	38,610	133	1,464	41,611	3.02	54	24	15	93	224	20,872	1.99
Total Missouri [9]	2,143,747	1,334,279	16,146	[8] 25,705	3,519,877	2.38	2,286	635	590	3,511	216	757,600	4.65

MONTANA

Montana bituminous:					10,833	$4.06							
Blaine		10,683	150		635,839	2.31	12		2	14	275	3,850	2.81
Carbon	584,400	46.589	4,125	725	438.569	1.80	205		108	313	263	82,278	7.73
Cascade	401,335	36,169	948	117	3,741	3.84	224		40	264	223	58,762	7.46
Chouteau		3,721	20		2.235	2.55	4		2	6	183	1,100	3.40
Fergus		2,194	35	6	2,547	5.16	3		1	4	246	984	2.27
Flathead		2,247		300	4.551	4.02	4		2	6	120	720	3.54
Hill		4.471	80		970,246	2.21	5		2	7	240	1,680	2.71
Musselshell	908,806	54,296	4,432	2,712	1,338	2.03	424		183	607	233	141,414	6.86
Park		1,313	25		1,004	2.19	1		1	2	170	340	3.94
Powder River		1.004			1,708,641	.95	1			1	160	160	6.28
Rosebud	1,705,160	1.882	1,599				1	72	20	93	299	27,784	[10] 61.50
Total bituminous	3.599,701	164,569	11,414	3,860	3,779,544	1.62	884	72	361	1.317	242	310,072	[8] 11.85
Montana lignite	(12)	[12] 48,990	(12)	[12] 148	49.138	1.89	51	14	17	82	143	11.722	4.19
Total Montana	[12] 3,599,701	[12] 213.559	[12] 11.414	[8] [12] 4,008	3,828,682	1.63	935	86	.378	1,399	236	330.794	11.57

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
NEW MEXICO													
Colfax	892,568	18,512	4,235	2,977	918,292	$2.92	577		160	737	246	181,199	5.07
McKinley	501,107	63,240	5,000	27,242	596,589	3.46	686		240	926	268	247,764	2.41
Rio Arriba	14,328	3,430			17,758	2.77	32		8	40	237	9,461	1.88
Sandoval		6,023			6,023	3.35	18		5	23	171	3,928	1.53
San Juan		6,301			6,301	2.65	16		4	20	137	2,740	2.30
Santa Fe	99,699	10,423	3,188	5,376	118,686	3.35	199		51	250	303	75,850	1.56
Other counties (Bernalillo and Socorro)	183	4,662	18	147	5,010	3.60	18		9	27	128	3,461	1.45
Total New Mexico	1,507,885	112,591	12,441	[8] 35,742	1,668,659	3.15	1,546		477	2,023	259	524,403	3.18
NORTH DAKOTA (LIGNITE)													
Total North Dakota	1,882,107	525,118	[11] 94,974	[8] 34,817	2,537,016	$1.40	491	386	307	1,184	205	242,581	[8] 10.46
OHIO													
Athens	2,226,035	123,028	6,096	16,330	2,371,489	$2.23	1,560	20	493	2,073	224	463,721	5.11
Belmont	8,599,447	234,185	25,889	21,564	8,881,085	2.13	5,550	116	1,058	6,724	255	1,711,875	5.19
Carroll	209,689	457,975	2,530	86	670,280	2.37	321	105	80	506	244	123,659	5.42
Columbiana	88,443	945,614	972	205	1,035,234	2.05	228	194	104	526	235	123,635	[10] 8.37
Coshocton	26,764	319,399	1,156	1,429	348,748	2.29	312	23	56	391	210	82,032	4.25

OHIO—Continued

Gallia	8,011	90,495	40		98,546	$2.29	89	10	24	123	237	29,127	3.38
Guernsey	598,619	69,070	2,510	146	670,345	2.08	488	19	66	573	250	143,073	4.69
Harrison	5,400,279	48,429	1,448	12,819	5,462,975	1.96	1,363	479	596	2,438	234	571,116	[9] 9.57
Hocking	285,321	137,853	15,380	100	438,654	2.25	389	6	58	453	237	107,291	4.09
Holmes		39,178	50	10	39,238	2.53	20	4	8	32	239	7,632	5.14
Jackson	61,447	99,580	20,691		181,718	2.50	224	33	39	296	217	64,355	2.82
Jefferson	5,906,501	512,278	9,329	10,572	6,438,680	2.07	2,751	334	860	3,945	255	1,006,511	[9] 6.40
Lawrence		63,738	4		63,742	2.30	89		20	109	249	27,110	2.35
Mahoning	24,975	292,596	847	3,276	321,694	2.52	17	105	18	140	274	38,390	[10] 8.38
Meigs	157,108	112,407	233		269,748	2.16	286		64	350	198	69,419	3.89
Morgan	221,193	9,217	50		230,460	2.23	181		38	219	274	60,094	3.83
Muskingum	1,123,470	300,843	25,533	377	1,450,223	1.83	798	54	141	993	236	233,918	6.20
Noble	83.706	3,079	319	4,677	91,781	2.30	100		20	120	212	25,438	3.61
Perry	730,787	309,331	1,699	208	1,042,025	2.05	839	53	191	1,083	184	199,427	5.23
Portage		82,242	200	640	83,082	2.91	13	12	9	34	303	10,310	[10] 8.06
Stark	158	540,752	587	613	542,110	2.17	64	192	71	327	200	65,350	[10] 8.30
Tuscarawas	104,322	1,787,173	295	188	1,891,978	2.17	752	343	235	1,330	230	306,393	6.18
Vinton	3,481	109,027	1,654		114,162	2.41	54	60	24	138	237	32,639	3.50
Other counties (Washington and Wayne)		26,471			26,471	2.27	10	7	5	22	218	4,805	5.51
Total Ohio	25,859,756	6,713,960	117.512	[8] 73,240	32,764,468	2.10	16,498	2,169	4,278	22,945	240	5,507,320	5.95

OKLAHOMA

Coal		26,067	189	24	26,280	$4.34	57		14	71	184	13,067	2.01
Latimer	17,378	3,432			20,810	3.27	48		11	59	146	8,594	2.42
Le Flore	448,192	970	653	3,173	452,988	3.65	663		133	796	202	160,671	2.82
McIntosh		1,563	10		1,573	3.55		2		2	180	360	4.37
Muskogee	52,134	896			53,030	2.55	21	41	30	92	161	14,776	3.59
Okmulgee	499,499	32,528	98	1,087	533,212	2.53	438		63	501	243	121,582	4.39
Pittsburg	186,047	22,638	589	3,669	212,943	3.88	303		66	369	237	87,348	2.44
Rogers	289,128	36,980		5,797	331,905	2.37		94	59	153	242	36,964	[10] 8.98
Tulsa	1,051	23,750	52		24,853	3.45	42		9	51	217	11,080	2.24
Other counties:													
Craig and Wagoner	631,556	35,124	408	300	667,388	2.36		93	57	150	280	41,928	[10] 15.92
Haskell and Sequoyah	60,235	1,177	53	745	62,210	2.89	46	37	27	110	128	14,087	4.42
Total Oklahoma	2,185,220	185,125	2,052	[8] 14,795	2,387,192	2.84	1,618	267	469	2,354	217	510,457	4.68

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and ouput per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
OREGON													
Total Oregon	----------	2,120	17	----------	2,137	$4.44	7	----------	1	8	173	1,384	1.54
PENNSYLVANIA (BITUMINOUS COAL)													
Allegheny	13,905,396	2,542,082	1,242,768	6,886	17,697,132	$2.34	10,678	339	1,788	12,805	254	3,252,671	5.44
Armstrong	5,416,598	268,963	54,604	1,258	5,741,423	2.36	3,950	159	550	4,659	246	1,145,786	5.01
Beaver	21,845	570,493	468	124	592,930	2.32	156	110	100	366	233	85,106	[9] 6.97
Bedford	242,942	128,840	238,380	737	610,899	2.76	680	----------	86	766	243	185,850	3.29
Blair	70,772	113,123	1,128	----------	185,023	2.76	252	----------	29	281	250	70,318	2.63
Bradford	----------	9,069	----------	----------	9,069	3.75	10	----------	2	12	224	2,682	3.38
Butler	579,784	607,887	9,105	512	1,197,288	2.41	872	172	198	1,242	228	282,588	4.24
Cambria	17,350,197	664,232	1,955,705	[13] 295,653	20,265,787	2.70	16,397	71	2,819	19,287	252	4,850,749	4.18
Center	750,692	264,387	348	174	1,015,601	2.36	896	57	133	1,086	223	242,268	4.19
Clarion	3,002,903	397,287	47,631	89	3,447,910	2.16	1,332	411	278	2,021	245	495,846	[9] 6.95
Clearfield	4,596,683	508,092	12,278	28,071	5,145,124	2.46	4,172	331	777	5,280	242	1,275,982	4.03
Clinton	205,667	84,612	97	20	290,396	2.33	69	81	46	196	257	50,428	5.76
Elk	643,684	134,801	4,792	19,260	802,537	2.36	690	2	205	897	253	226,755	3.54
Fayette	18,397,561	2,860,452	145,315	[13] 4,449.771	25,853,099	2.56	18,601	281	2,450	21,332	273	5,818,994	4.44
Greene	7,257,993	87,615	16,461	[13] 19,995	7,382,064	2.45	4,730	----------	829	5,559	265	1,473,216	5.01
Huntingdon	376,845	94,789	4,544	2,848	479,026	2.92	630	----------	91	721	249	179,367	2.67
Indiana	8,028,018	217,082	349,056	[13] 463,656	9,057,812	2.37	6,212	----------	965	7,177	254	1,820,440	4.98
Jefferson	1,938,209	238,006	3,737	4,349	2,184,301	2.33	1,752	94	284	2,130	240	510,531	4.28
Lawrence	134,736	157,506	2,883	274	295,399	2.34	265	43	45	353	216	76,246	3.87
Lycoming	760	41,443	25	----------	42,228	2.83	62	2	14	78	208	16,212	2.60
McKean	----------	5,417	319	----------	5,736	2.58	3	4	3	10	197	1,966	2.92
Mercer	105,424	391,939	1,227	12	498,602	2.33	185	47	72	304	262	79,655	[10] 6.26
Somerset	6,859,120	232,250	83,540	59,565	7,184,475	2.64	6,117	56	952	7,125	241	1,716,737	4.18

Tioga	265, 720	90, 622	221	1, 931	358, 494	$2. 87	233	29	69	331	232	76, 802	4. 67
Venango		21, 728			21, 728	2. 48	23	2	7	32	227	7, 260	2. 99
Washington	19, 699, 952	711, 650	280, 409	23, 364	20, 715, 375	2. 43	14, 699	442	2, 014	17, 155	251	4, 299, 395	4. 82
Westmoreland	9, 084, 750	1, 794, 866	216, 400	[13] 1, 631, 857	12, 727, 873	2. 38	7, 268	464	1, 259	8, 991	257	2, 306, 779	5. 52
Other counties (Fulton, Forest, and Cameron)	255, 140	10, 718			265, 858	2. 90	158	12	25	195	257	50, 032	5. 31
Total Pennsylvania	119, 191, 391	13, 249, 951	4, 621, 441	[13] 7, 010, 406	144, 073, 189	2. 48	101, 092	3, 209	16, 090	120, 391	254	30, 600, 661	4. 71

SOUTH DAKOTA (LIGNITE)

Total South Dakota	([13])	[13] 53, 415	105	[5] 18	53, 538	$1. 94	11	33	7	51	198	10, 118	5. 29

TENNESSEE

Anderson	1, 446, 333	26, 171	13, 319	209	1, 486, 032	$2. 54	1, 252		163	1, 415	248	350, 660	4. 24
Bledsoe	46, 602	2, 607	447	109	49, 765	2. 35	77		13	90	215	19, 332	2. 57
Campbell	2, 109, 970	70, 886	33, 154	526	2, 214, 536	2. 73	2, 305		398	2, 703	243	657, 054	3. 37
Claiborne	1, 873, 430	38, 847	17, 889	4, 429	1, 934, 595	2. 43	1, 766		257	2, 023	262	530, 760	3. 64
Cumberland	7, 063	32, 106	230	536	39, 935	2. 06	74		20	94	210	19, 706	2. 03
Fentress	336, 521	51, 583	2, 446	3, 184	393, 734	2. 13	292		91	383	271	103, 907	3. 79
Grundy	552, 972	1, 522	8, 059	[14] 5, 152	567, 705	2. 52	572		71	643	250	160, 756	3. 53
Hamilton	28, 818	50, 644	127		79, 589	2. 50	109		28	137	174	23, 818	3. 34
Marion	542, 088	65, 927	4, 716	1, 391	614, 122	2. 83	694		174	868	225	195, 077	3. 15
Morgan	113, 675	30. 536	1, 441	11, 860	157, 512	2. 28	256.		52	308	280	86, 384	1. 82
Overton	121, 057	8, 573	12, 240	174	142, 044	1. 84	130		19	149	274	40, 813	3. 48
Scott	166, 023	23, 036	2, 677	2, 335	194, 071	2. 41	251		49	300	235	70, 428	2. 76
Sequatchie	71, 864	92, 989	377	480	165, 710	2. 45	220		32	252	221	55, 748	2. 97
White		10, 719	20	40	10, 779	2. 21	19		7	26	199	5, 168	2. 09
Other counties:													
Putnam and Roane	46, 107	9, 665	675		56, 447	2. 09	89		31	120	171	20, 474	2. 76
Rhea and Van Buren		51, 333	128	200	51, 661	2. 75	86		21	107	241	25. 812	2. 00
Total Tennessee	7, 462, 523	567, 144	97, 945	[14] 30, 625	8, 158, 237	2. 54	8, 192		1, 426	9. 618	246	2, 365, 897	3. 45

TEXAS

Texas bituminous: Palo Pinto and Wise	9, 053	4, 057	100		13, 210	$4. 17	44		10	54	77	4, 164	3. 17
Total bituminous	9, 053	4, 057	100		13, 210	4. 17	44		10	54	77	4, 164	3. 17
Texas lignite	286, 110	1, 597		3, 262	290, 969	. 85	130	32	11	173	194	33, 483	[10] 8. 69
Total Texas	295, 163	5, 654	100	[5] 3, 262	304, 179	. 99	174	32	21	227	166	37, 647	8. 08

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
UTAH													
Carbon	4,019,082	272,247	28,750	[15] 50,116	4,370,195	$2.60	1,827		692	2,519	253	636,622	6.86
Emery	901,987	121,982	3,676	5,886	1,033,531	2.54	383		151	534	251	133,937	7.72
Grand	40,843	2,170	124	29	43,166	2.70	36		12	48	248	11,882	3.63
Iron		6,276	53		6,329	3.54	6		1	7	254	1,775	3.57
Sevier		15,757			15,757	2.12	8		2	10	250	2,500	6.30
Summit	23,182	21,311	498		44,991	2.09	27		14	41	260	10,651	4.22
Uintah		2,480	400		2,880	4.00	5		2	7	200	1,400	2.06
Total Utah	4,985,094	442,223	33,501	[15] 56,031	5,516,849	2.59	2,292		874	3,166	252	798,767	[16] 6.91
VIRGINIA													
Buchanan	5,949,718	4,184	21,689	3,106	5,978,697	$2.60	4,016		476	4,492	241	1,081,923	5.53
Dickenson	2,060,030	13,240	9,454	772	2,083,496	2.44	1,784		224	2,008	270	542,948	3.84
Lee	1,447,167	95,522	14,293	2,274	1,559,256	2.71	1,450		227	1,677	248	415,877	3.75
Russell	1,055,503	79,150	9,793	2,246	1,146,692	2.51	999		137	1,136	249	282,967	4.05
Tazewell	4,256,061	49,515	38,506	8,417	4,352,499	2.81	4,072		677	4,749	239	1,136,992	3.83
Wise	4,077,010	113,566	26,203	[17] 568,689	4,785,468	2.41	4,431		603	5,034	245	1,232,838	3.88
Other counties (Montgomery and Scott)	184,468	40,936	3,917	750	230,071	2.59	261		59	320	224	71,605	3.21
Total Virginia	19,029,957	396,113	123,855	[17] 586,254	20,136,179	2.59	17,013		2,403	19,416	245	4,765,150	4.23
WASHINGTON													
King	251,271	374,227	3,847	436	629,781	$4.41	647	5	159	811	270	219,043	2.88
Kittitas	854,274	36,061	49,071	11,844	951,250	3.57	739		230	969	283	273,892	3.47
Lewis	9,439	42,023	106	301	51,869	3.09	45		9	54	278	15,019	3.45
Pierce	6,566	20,334	194	65	27,159	4.20	26		6	32	258	8,266	3.29
Other counties (Thurston and Whatcom)	213,286	74,400	1,674	3,790	293,150	3.75	232		56	288	258	74,288	3.95
Total Washington	1,334,836	547,045	54,892	[4] 16,436	1,953,209	3.87	1,689	5	460	2,154	274	590,508	3.31

Barbour	1,841,807	24,143	4,791	92	1,870,833	$2.01	1,331	14	221	1,566	223	349,176	5.36
Boone	5,111,235	7,594	25,444	1,800	5,146,073	2.20	8,348		652	4,000	246	982,679	5.24
Braxton	23,722	10,092	476		34,290	1.96	37		11	48	212	10,155	3.38
Brooke	883,495	502,405	956,732	49	2,342,681	2.06	958	151	198	1,307	233	304,570	[8] 7.69
Clay	853,342	4,061	12,725	24,277	894,405	2.39	652		177	829	298	247,104	3.62
Fayette	12,991,980	25,216	380,912	[18] 387,894	13,786,002	2.66	11,120	11	1,841	12,972	245	3,183,228	4.83
Grant		71,182	365	152	71,699	2.62	104		16	120	278	33,340	2.15
Greenbrier	2,145,471	63,931	10,832	242	2,220,476	2.69	1,802	20	266	2,088	233	486,508	4.56
Hancock	30,111	119,651	18		149,780	2.11	12	25	10	47	274	12,898	[8] 11.61
Harrison	6,513,598	64,500	70,369	1,600	6,650,067	2.06	2,773	244	687	3,704	233	862,963	[8] 7.71
Kanawha	8,654,032	77,272	46,473	7,917	8,785,694	2.37	6,414		861	7,275	258	1,875,177	4.69
Lincoln		2,528			2,528	2.12	6			6	208	1,245	2.03
Logan	21,872,089	11,683	112,326	6,621	22,002,719	2.30	10,806		2,660	13,466	245	3,297,202	[16] 6.67
McDowell	27,337,435	53,646	333,670	83,083	27,807,834	2.64	19,151		3,974	23,125	263	6,086,536	4.57
Marion	11,559,314	97,094	286,607	37,541	11,980,556	2.16	6,084	91	1,062	7,237	260	1,882,048	[8] 6.37
Marshall	583,474	135,989	185,029	3,792	908,284	2.29	585	12	79	676	260	175,731	5.17
Mason	9,070	50,646	6,837		66,553	2.30	144		23	167	134	22,317	2.98
Mercer	3,436,544	22,352	29,682	636	3,489,214	2.75	2,817		595	3,412	247	841,555	4.15
Mineral	160,935	39,025	51	87	200,098	2.82	243		53	296	234	69,389	2.88
Mingo	4,926,815	11,093	29,962	95	4,967,965	2.34	3,101		690	3,791	251	951,216	5.22
Monongalia	11,234,939	134,812	13,472	[18] 34,896	11,418,119	2.05	4,491	35	1,034	5,560	277	1,540,532	[8] 7.41
Nicholas	371,313	40,241	5,395		416,949	2.33	339		38	377	274	103,181	4.04
Ohio	1,863,806	232,009	8,421	14	2,104,250	2.17	1,520		215	1,735	286	495,932	4.24
Preston	1,512,234	20,867	140,080	[18] 133,820	1,807,001	2.46	1,312	101	266	1,679	248	415,890	4.34
Putnam	209,248	11,424	1,365		222,037	2.28	209		25	234	252	58,954	3.77
Raleigh	15,670,891	55,663	127,912	49,945	15,904,411	2.70	11,468	38	2,198	13,704	251	3,444,028	4.62
Randolph	1,655,260	73,083	8,437	[18] 21,015	1,757,795	1.94	1,320	8	312	1,640	257	422,173	4.16
Taylor	895,678	24,319	713	3,973	924,683	2.01	599	18	121	738	241	178,064	5.19
Tucker	638,741	4,507	3,438	24,277	670,963	2.70	541		55	596	258	153,915	4.36
Upshur	359,936	20,537	446	2,942	383,861	2.01	228		53	281	248	69,619	5.51
Wayne	124,876	29,275			154,151	1.90	139		41	180	190	34,201	4.51
Webster	1,546,502	5,561	683	5,150	1,557,896	2.65	1,094		210	1,304	247	322,424	4.83
Wyoming	5,025,134	10,363	32,564	21,816	5,089,877	2.83	3,583		662	4,245	256	1,087,332	4.68
Other counties (Gilmer and Lewis)	69,573	21,690	490		91,753	2.03	100		17	117	281	32,898	2.79
Total West Virginia	150,112,600	2,078,454	2,836,717	[18] 853,726	155,881,497	2.42	98,431	768	19,323	118,522	253	30,034,180	5.19

WYOMING

Campbell	88,007	24,031	620	8,777	121,435	$1.21		18	12	30	263	7,902	15.37
Carbon	830,289	32,893	3,217	23,616	890,015	2.13	292	26	98	416	240	99,980	8.90
Converse		15,528	47	64	15,639	2.32	2	8	2	12	222	2,667	5.86
Fremont	5,606	11,691	47	1,167	18,511	2.96	32		11	43	89	3,848	4.81
Hot Springs	103,648	24,151	126	4,715	132,640	3.44	116		38	154	208	32,072	4.14
Johnson		11,593	90	275	11,958	2.22	10		4	14	242	3,392	3.53

See footnotes at end of table.

TABLE 54.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1942*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
WYOMING—Continued													
Lincoln	548, 807	24, 145	4, 565	3, 471	580, 988	2. 73	380		110	490	227	111, 321	5. 22
Natrona		1, 541			1, 541	3. 15	4		1	5	189	945	1. 63
Sheridan	744, 993	35, 258	2, 681	1, 245	784, 177	1. 89	223	2	78	303	240	72, 853	10. 76
Sweetwater	5, 469, 416	12, 935	25, 982	53, 027	5, 561, 360	2. 19	2, 564		557	3, 121	271	846, 765	6. 57
Uinta	7, 184	7, 584	53	140	14, 961	2. 40	14		4	18	303	5, 451	2. 74
Total Wyoming	7, 797, 950	201, 350	37, 428	[5] 96, 497	8, 133, 225	2. 20	3, 637	54	915	4, 606	258	1, 187, 196	[8] 6. 85

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[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding for shipment by rail, and hauled by truck to waterway for shipment by water.

[2] Includes coal transported from mines to points of use by conveyor or tram.

[3] Value received or charged for coal f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

[4] Includes 26,756 tons made into beehive coke at mines in Jefferson County, Ala., in 1942.

[5] No coal was made into beehive coke at mines in 1942.

[6] Includes 136,905 tons made into beehive coke at mines in Las Animas County, Colo., in 1942.

[7] "Other counties" in Illinois include Bond, Jefferson, Logan, Marion, Marshall, Tazewell, Wabash and Will.

[8] Much of the output is obtained from strip pits and by use of mechanical loading devices, in which types of operations production per man per day is large.

[9] Production of Alston Coal Co. (Alston mine) and Hume-Sinclair Coal Mining Co. (Foster mine) is credited to Missouri, and production of Hume-Sinclair Coal Mining Co. (Tiger mine) is credited to Kansas.

[10] The output is obtained chiefly from strip pits in which the production per man per day is large.

[11] Includes 1,897 tons made into beehive coke at mines in Jackson County, Ky., in 1942.

[12] In Montana and South Dakota some lignite "Loaded for shipment" is included in "Shipped by truck or wagon." In Montana some "Used by employees" is included with "Used at mine for power and heat." In North Dakota some lignite "Made into briquets" is included with "Other uses at mine."

[13] Includes coal made into beehive coke at mines in the following counties in Pennsylvania in 1942: Cambria, 124,182 tons; Fayette, 4,412,417 tons; Greene, 4,403 tons; Indiana, 347,398 tons; Westmoreland, 1,600,048 tons; grand total, 6,488,448 tons.

[14] Includes 4,277 tons made into beehive coke at mines in Grundy County, Tenn., in 1942.

[15] Includes 43,674 tons made into beehive coke at mines in Carbon County, Utah, in 1942.

[16] The output is obtained chiefly by the use of mechanical loading devices in which type of operation the production per man per day is large.

[17] Includes 563,356 tons made into beehive coke at mines in Wise County, Va., in 1942.

[18] Includes coal made into beehive coke at mines in the following counties in West Virginia in 1942: Fayette, 345,406 tons; Monongalia, 34,539 tons; Preston, 130,476 tons; Randolph, 986 tons; grand total, 511,407 tons.

SUMMARY OF SMALL MINES

TABLE 55.—*Summary of data on mines in the United States producing less than 1,000 tons a year, by States and Districts, in 1942* [1]

[Figures compiled from schedules actually received and supplemented by State mine inspectors' reports where available. It was not possible to obtain complete coverage. The data shown in this table are not included in the other parts of this report.]

	Number of active mines	Total production	Average value per ton	Average number of employees	Average number of days mines were active	Number of man-days worked	Average tons per man per day
By States:							
Alabama	121	44,830	$2.79	387	75	29,088	1.54
Arkansas	56	17,587	3.60	154	71	10,956	1.61
Colorado	94	40,792	3.28	225	96	21,663	1.88
Idaho	2	1,002	3.30	5	192	960	1.04
Illinois	247	66,607	2.41	643	62	39,785	1.67
Indiana	129	46.827	2.16	268	92	24,571	1.91
Iowa	78	32,130	2.84	302	71	21,491	1.50
Kansas	42	16,602	2.92	133	84	11,238	1.48
Kentucky	835	354,258	2.23	2,015	121	243,339	1.46
Maryland	67	27,396	2.60	134	97	12,941	2.12
Michigan	1	300	2.35	2	150	300	1.00
Missouri	217	68,808	2.67	638	90	57,653	1.19
Montana	75	25,067	3.58	153	117	17,875	1.40
New Mexico	35	15,116	3.14	104	106	11,041	1.37
Ohio	498	181,643	2.28	1,029	91	93,659	1.94
Oklahoma	66	26,484	3.39	252	74	18,740	1.41
Oregon	1	804	4.19	3	220	660	1.22
Pennsylvania	523	215,093	2.38	1,089	92	100,698	2.14
Tennessee	64	24,176	2.20	188	86	16,089	1.50
Texas	1	145	4.03	2	99	198	.73
Utah	21	9,952	2.69	57	74	4,204	2.37
Virginia	52	18,952	2.42	139	77	10,711	1.77
Washington	14	4,225	3.81	32	75	2,412	1.75
West Virginia	408	146,078	2.18	981	66	64,440	2.27
Wyoming	47	15,081	3.09	96	102	9,765	1.54
Other States [2]	3	340	1.97	21	206	5,450	.06
Total	3,697	1,400,295	2.45	9.052	92	829,927	1.69
By producing districts: [3]							
District 1. Eastern Pennsylvania	376	160,928	2.41	767	96	73,636	2.19
District 2. Western Pennsylvania	228	87,431	2.39	496	86	42,604	2.05
District 3. Northern West Virginia	189	71,269	2.05	453	62	28,312	2.52
District 4. Ohio	498	181,643	2.28	1,029	91	93,659	1.94
District 5. Michigan	1	300	2.35	2	150	300	1.00
District 6. Panhandle	28	9,125	2.48	54	95	5,151	1.77
District 7. Southern numbered 1	50	19,242	2.52	145	63	9,087	2.12
District 8. Southern numbered 2	918	366,491	2.31	2,206	115	253,536	1.45
District 9. Western Kentucky	129	57,393	1.74	343	96	32,760	1.75
District 10. Illinois	247	66,607	2.41	643	62	39,785	1.67
District 11. Indiana	129	46,827	2.16	268	92	24,571	1.91
District 12. Iowa	78	32,130	2.84	302	71	21,491	1.50
District 13. Southeastern	155	59,244	2.64	490	77	37,670	1.57
District 14. Arkansas-Oklahoma	81	28,680	3.52	268	72	19,407	1.48
District 15. Southwestern	301	100,946	2.83	911	87	79,378	1.27
District 16. Northern Colorado	13	6,363	2.92	28	110	3,072	2.07
District 17. Southern Colorado	87	37.512	3.34	223	94	20,858	1.80
District 18. New Mexico	29	12,033	3.11	78	112	8,774	1.37
District 19. Wyoming	49	16,083	3.11	101	106	10,725	1.50
District 20. Utah	21	9,952	2.69	57	74	4,204	2.37
District 22. Montana	75	25,067	3.58	153	117	17,875	1.40
District 23. Washington and Oregon	15	5,029	3.87	35	88	3,072	1.64
Total	3,697	1,400,295	2.45	9,052	92	829,927	1.69

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[1] Data on small lignite mines in Montana, North Dakota, South Dakota, and Texas not available.
[2] Includes Georgia and North Carolina.
[3] For boundaries of districts, see Bituminous Coal Act of 1937 and modifications thereto.

STATISTICS ON LIGNITE IN 1942 [1]

PRODUCTION

The statistics in this chapter on the lignite industry in the United States were compiled from annual reports received from producers of lignite in the areas mapped as lignite in Geological Survey Professional Paper 100–A, The Coal Fields of the United States. Subbituminous coal, sometimes called black lignite, is not included in these statistics.

The production of lignite in 1942 totaled 2,930,661 net tons, exclusive of some small mines that produced less than 1,000 tons. Output in 1942 showed a slight increase over the 2,775,832 tons produced in 1941. The average value per ton was $1.36 in 1942 compared with $1.24 in 1941. The total employees in 1942 numbered 1,490 against 1,644 in 1941; and the average output per man per day, based upon calculated man-days, for the same periods was 9.84 and 9.54 tons, respectively. The length of the working day in most of the mines was 8 hours. Some mines showed a 7-hour day on their reports to the Bureau and a few a 9-hour day; some of the small mines did not reply to this question. No labor disturbances were reported.

As for many years in the past, North Dakota was the chief producer of lignite in 1942, followed in order by Texas, South Dakota, and Montana. The North Dakota output comprised 87 percent of the total production, that of Texas 10, and the outputs of South Dakota and Montana, taken together, 3 percent.

The following tables contain detailed statistics for lignite in 1942. Statistics of the lignite industry in 1943 were not available for publication in this chapter but may be obtained in mimeographed form upon request to the Coal Economics Division of the Bureau of Mines.

TABLE 56.—*Summary of production, value, men employed, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1942, by States*

	North Dakota	Texas	South Dakota	Montana (1)	Total
Production (net tons):					
Loaded at mines for shipment	1,882,107	286,110	(2)	(2)	2,168,217
Commercial sales by truck or wagon	525,118	1,597	[2] 53,415	[2] 48,990	629,120
Used by employees, taken by locomotives at tipple, and other uses	[3] 94,974		105	[4] 148	95,227
Used at mines for power and heat	34,817	3,262	18	(4)	38,097
Total production: 1942	2,537,016	290,969	53,538	49,138	2,930,661
1941	2,308,888	337,326	70,825	58,793	2,775,832
Value:					
Total: 1942	$3,554,000	$246,000	$104,000	$93,000	$3,997,000
1941	$2,937,000	$284,000	$108,000	$105,000	$3,434,000
Average per ton: 1942	$1.40	$0.85	$1.94	$1.89	$1.36
1941	$1.27	$0.84	$1.52	$1.79	$1.24
Number of employees:					
Underground	491	130	11	51	683
Surface (including strip pits)	693	43	40	31	807
Total employees: 1942	1,184	173	51	82	1,490
1941	1,275	202	69	98	1,644
Average number of days mines operated:					
1942	205	194	198	143	200
1941	177	180	174	174	177
Man-days of labor: 1942 [5]	242,581	33,483	10,118	11,722	297,904
Average output per man per day (tons): 1942 [5]	10.46	8.69	5.29	4.19	9.84

[1] Includes output of Custer, Dawson, McCone, Richland, Roosevelt, Sheridan, and Valley Counties.
[2] Some "Loaded at mine for shipment" included in "Commercial sales by truck or wagon."
[3] Includes some lignite "made into briquets."
[4] Some colliery fuel is included in "Other uses."
[5] Based upon calculated number of man-days.

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[1] Compiled by J. A. Corgan and M. I. Cooke.

TABLE 57.—*Production, value, men employed, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1942, by States and counties*

County	Total tons produced (net tons)	Value: Total (thousand dollars)	Value: Average per ton	Total number of employees	Man-days of labor [1]	Average number of days mine operated	Average tons per man per day [1]
MONTANA							
Custer, Dawson, and Valley	19, 967	39	$1. 95	25	4, 395	176	4, 54
McCone, Richland, and Roosevelt	8, 950	18	2. 01	28	2, 898	101	3. 09
Sheridan	20. 221	36	1. 78	29	4, 429	153	4. 57
Total	49, 138	93	1. 89	82	11, 722	143	4. 19
NORTH DAKOTA							
Adams	57, 451	105	$1. 83	72	11, 742	163	4. 89
Billings and Bowman	10, 569	23	2. 18	15	2, 425	162	4. 36
Burke	326, 424	467	1. 43	72	18, 405	256	[2] 17. 74
Burleigh	303, 909	401	1. 32	72	14, 852	206	[2] 20. 46
Divide	217, 550	291	1. 34	65	10, 409	160	[2] 20. 90
Dunn	6, 796	14	2. 06	19	1, 507	79	4. 51
Golden Valley	8, 164	15	1. 84	14	1, 642	117	4. 97
Grant	28, 573	48	1. 68	33	4, 356	132	6. 56
Hettinger	19, 706	24	1. 73	30	4, 392	146	4. 49
McKenzie	3, 561	7	1. 97	8	985	123	3. 62
McLean	135, 915	204	1. 50	99	17, 613	178	7. 72
Mercer	682, 332	941	1. 28	233	59, 134	254	11. 54
Morton	34, 957	58	1. 66	42	6, 118	146	5. 71
Mountrail	14, 434	27	1. 87	23	4, 060	177	3. 56
Oliver and Slope	8, 437	11	1. 30	14	1, 680	120	5. 02
Stark	128, 351	164	1. 28	93	26, 556	286	4. 83
Ward	517, 231	688	1. 33	225	48, 678	216	[2] 10. 63
Williams	32, 656	56	1. 71	55	8, 027	146	4. 07
Total	2, 537, 016	3, 554	1. 40	1, 184	242, 581	205	10. 46
SOUTH DAKOTA							
Corson and Dewey	48, 226	92	$1. 91	34	8, 094	238	5. 96
Harding and Meade	1, 859	5	2. 69	8	840	105	2. 21
Perkins	3, 453	7	2. 03	9	1, 184	132	2. 92
Total	53, 538	104	1. 94	51	10, 118	198	5. 29
TEXAS							
Henderson, Milam, and Wood	290, 969	246	$0. 85	173	33, 483	194	8. 60

[1] Based upon "calculated" man-days.
[2] Output is obtained chiefly from strip pits in which the production per man per day is large.

METHODS OF RECOVERY

TABLE 58.—*Lignite mined by different methods in the United States in 1942, by States, in net tons*

State	Mined by hand	Shot off the solid	Cut by machines [1]	From strip pits	Total
Montana	[2] 18, 807	[2] 229, 737	4, 846	[2] 86, 717	49, 138
North Dakota	5, 066	147, 387	669, 074	1, 715, 489	2, 537, 016
South Dakota	(3)	[3] 4, 362		49, 176	53, 538
Texas	(2)	(2)		(2)	290, 969
Total	23, 873	381, 486	673, 920	1, 851, 382	2, 930, 661

[1] A total of 25 machines was used—16 "permissible" and 9 other types.
[2] Montana includes Texas.
[3] Mined by hand included under "Shot off the solid."

NUMBER AND SIZE OF LIGNITE MINES

For 1942 the Bureau of Mines received reports from 173 lignite mines (exclusive of some mines producing less than 1,000 tons a year). Six mines produced 200,000 to 500,000 tons each, and the output of these mines amounted to 64 percent of the total production; 2 reported production from 100,000 to 200,000 tons and supplied 10 percent of the total output; 2 mines reported an output of 50,000 to 100,000 tons each and contributed 6 percent of the total tonnage; 15 mines in the 10,000- to 50,000-ton class reported 11 percent of the total production; and 148 mines producing less than 10,000 tons each furnished 9 percent of the total output of the industry. The greatest number of mines were located in North Dakota, which State had 141. Montana was next in order with 16 mines; South Dakota and Texas followed with 11 and 5, respectively. In the field as a whole the classification by size of output in 1942 is given in table 59.

TABLE 59.—*Number and production of lignite mines, classified by size of ouput, in 1942*

Classes	Mines		Production		
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent
1. 200,000-500,000 tons	6	3.4	1,865,461	310,910	63.7
2. 100,000-200,000	2	1.2	298,466	149,233	10.2
3. 50,000-100,000	2	1.2	176,124	88,062	6.0
4. 10,000-50,000	15	8.7	311,428	20,762	10.6
5. Under 10,000	148	85.5	279,182	1,886	9.5
Total	173	100.0	2,930,661	16,940	100.0

STRIPPING OPERATIONS

The production of lignite from strip pits in 1942 amounted to 1,851,382 tons—63 percent of the total output of the industry. As for many years in the past, most of the stripping was done in North Dakota, which produced 1,715,489 tons by that method. This represented 93 percent of all strip-pit production and 59 percent of the total tonnage produced by the lignite industry. The output from stripping operations in Texas, Montana, and South Dakota was only 135,893 tons. The number of men employed in stripping operations was 645, with an average output per man per day of 14.69 tons, and the average number of days worked was 196.

Detailed statistics for stripping operations in the lignite industry in 1942 are given in table 60.

TABLE 60.—*Summary of stripping operations that produced lignite in the United States in 1942, by States*

State	Number of strip pits [1]	Number of shovels, drag line excavators, and coal-loading machines [2]	Coal produced (net tons)		Total value at mines (thousand dollars)	Average value per ton	Number of employees				Average number of days mines operated	Man-days of labor [3]	Average tons per man per day [3]
			Mined by stripping	Total at same mines			Underground	Surface		Total			
								In strip pits	All others				
Montana and Texas	5	8	86,717	86,717	$58	$0.67	----	46	2	48	102	4,875	17.79
North Dakota	63	49	1,715,489	1,723,013	2,355	1.37	13	386	161	560	202	113,306	15.21
South Dakota	6	6	49,176	49,176	94	1.91	----	33	4	37	227	8,384	5.87
Total	74	63	1,851,382	1,858,906	2,507	1.35	13	465	167	645	196	126,565	14.69

[1] Includes some pits in which the stripping is done by hand.

[2] In some cases the same equipment was used for stripping or excavating and for loading the coal; this duplication has been eliminated. In some cases the coal was excavated by machine and loaded by hand.

[3] Based upon calculated man-days.

IMPORTS AND EXPORTS

TABLE 61.—*Bituminous coal* [1] *imported for consumption in the United States, 1942–43, by countries and customs districts, in net tons*

	1942	1943
Country		
North America:		
Canada	494,131	746,573
Mexico	....	72
Europe: United Kingdom [2]	3,412	10,989
Africa: Union of South Africa	560	....
	498,103	757,634
Customs district		
Alaska	9,763	33,349
Buffalo	....	483
Dakota	215	604
Duluth and Superior	377	123
Customs district—Continued		
Maine and New Hampshire	175,434	106,853
Maryland	380	784
Massachusetts	....	5,542
Montana and Idaho	247,836	498,072
New York	3,431	4,258
Philadelphia	....	1,383
St. Lawrence	12	....
Virginia	597	....
Washington	60,058	106,183
	498,103	757,634

[1] Includes slack, culm, and lignite.

[2] United Kingdom of Great Britain and Northern Ireland.

TABLE 62.—*Exports of bituminous coal to Canada and Mexico, the West Indies and Central America, and "overseas" destinations, 1939–43, in thousands of net tons*

Year	Canada and Mexico	West Indies and Central America	"Overseas" (all other countries): Newfoundland, Miquelon, Bermuda, Greenland, and Iceland	South America	Europe	Asia	Africa	Oceania	Total "Overseas"	Grand total
1939	9,976	599	76	681	165	91	2	....	1,015	11,590
1940	13,537	455	106	1,660	653	29	26	....	2,474	16,466
1941	18,196	332	186	1,541	370	25	62	28	2,212	20,740
1942	21,017	440	90	925	253	4	214	....	1,486	22,943
1943	24,272	462	111	589	298	....	108	....	1,106	25,840

TABLE 63.—*Bituminous coal exported from the United States, 1942–43, by countries, in net tons* [1]

Country	1942	1943
North America:		
Bermuda	4,477	6,261
Canada	21,016,470	24,269,530
Central America:		
British Honduras	74	66
Costa Rica	20	168
El Salvador	33	....
Guatemala	67	94
Honduras	164	103
Nicaragua	4	7
Panama:		
Canal Zone	100,313	47,757
Republic of	13	6
Greenland	668	2,836
Iceland	2,145	....
Mexico	964	2,323
Newfoundland and Labrador	82,579	102,207
West Indies:		
British:		
Barbados	3,714	....
Jamaica	33,158	19,757
Trinidad and Tobago	95,160	143,597
Other British	56	114
Cuba	197,156	233,728
Curaçao (N. W. I.)	530	172
Dominican Republic	97	69
French	8,940	16,132
Haiti	6	16
	21,546,808	24,844,943
South America:		
Argentina	172,988	128,172
Bolivia	30,076	20,409
Brazil	611,307	337,969
Chile	22,492	16,438
South America—Con.		
Falkland Islands	1,220	1,214
Surinam	7,634	2,299
Uruguay	79,098	82,819
Other South America	293	9
	925,108	589,329
Europe:		
Azores	8,487	8,359
Portugal	244,934	267,600
Spain	....	5,594
U. S. S. R	....	15,821
Other Europe	....	104
	253,421	297,478
Asia:		
Iraq	3,932	....
Other Asia	10	....
	3,942	....
Africa:		
Canary Islands	7,201	7,131
Cape Verde Islands	....	3,384
Egypt	152,597	77,740
Madeira Islands	9,903	9,433
Morocco:		
French	4,753	....
Spanish	33,932	10,662
Tangier	5,599	....
Other Africa	41	....
	214,026	108,350
	22,943,305	25,840,100

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[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in the foreign trade, which aggregated 1,584,763 tons in 1942 and 1,646,561 tons in 1943.

TABLE 64.—*Bituminous coal exported from the United States, 1942–43, by customs districts, in net tons*

Customs district	1942	1943	Customs district	1942	1943
North Atlantic:			Pacific Coast:		
			Los Angeles	----------	37
Maine and New Hampshire	1,817	5,620	San Diego	92	106
Massachusetts	2,363	4	Washington	1,046	22,534
New York	122,713	23,694	Northern border:		
Philadelphia	44,566	279,424	Buffalo	1,495,250	1,513,678
South Atlantic:			Chicago	179,047	1,058,754
Maryland	222,174	101,711	Dakota	10,893	55,100
North Carolina	----------	1,682	Duluth and Superior	37,112	270,131
South Carolina	1,147	----------	Michigan	1,679,483	2,539,950
Virginia	1,263,532	900,768	Montana and Idaho	49	----------
Gulf Coast:			Ohio	11,243,027	11,764,246
Florida	88,123	202,358	Rochester	3,687,813	4,146,174
Mobile	111,363	84,362	St. Lawrence	2,729,360	2,834,424
New Orleans	11,423	26,964	Vermont	8,557	692
Mexican border:			Wisconsin	1,061	581
Arizona	362	792	Miscellaneous: Alaska	527	5,192
El Paso	188	1,116			
Laredo	217	6		22,943,305	25,840,100

TABLE 65.—*Shipments of bituminous coal to noncontiguous Territories, 1942–43*

Territory	1942		1943	
	Net tons	Value	Net tons	Value
Alaska:				
Anthracite Bituminous	9,812	$205,255	11,269	$161,730
Hawaii	469	8,775	571	15,263
Puerto Rico	11,150	62,435	13,860	78,727
Virgin Islands	39,368	201,741	----------	----------

WORLD PRODUCTION

TABLE 66.—*World production of coal and lignite, 1938–43, by countries, in thousands of metric tons* [1]

[Compiled by B. B. Waldbauer, Bureau of Mines]

Country [1]	1938	1939	1940	1941	1942	1943
North America:						
Canada:						
Coal	9,815	10,985	12,638	12,872	13,018	11,539
Lignite	3,153	3,094	3,298	3,662	4,096	4,597
Greenland	7	(2)	6	(3)	(3)	(3)
Mexico	893	628	816	856	908	1,053
United States:						
Antracite	41,820	46,708	46,706	51,136	54,728	(5)
Bituminous	313,473	355,445	415,336	463,908	525,948	534,329
Lignite	2,720	2,760	2,666	2,518	2,659	
South America:						
Brazil	883	1,047	1,336	1,408	1,757	[4] 2,000
Chile	2,044	1,850	1,937	2,051	2,151	[4] 1,820
Colombia	331	349	521	403	415	(3)
Peru	75	108	113	117	[5] 120	(3)
Venezuela	6	3	5	6	9	11
Europe:						
Albania: Lignite	4	(2)	(3)	(3)	(3)	(3)
Belgium	29,585	29,847	(3)	(3)	(3)	(3)
Bulgaria:						
Coal	142	164	188	2,256	2,781	[4] 2,000
Lignite	1,855	2,134	2,700			
Czechoslovakia:						
Coal	15,800	(2)	(3)	(3)	(3)	(3)
Lignite	14,717	[6] 779	[6] 805	[6] 816	[6] 813	(3)
Denmark: Lignite	(3)	(3)	(3)	[4] 1,000	[4] 1,800	[4] 2,400
Eire	120	120	118	155	(3)	(3)
Faroe Islands: Lignite	8	8	(3)	(3)	(3)	(3)
France:						
Coal	46,498	51,000	[7] 21,662	(3)	[4] 43,000	(3)
Lignite	1,057					

See footnotes at end of table.

TABLE 66.—*World production of coal and lignite, 1938–43, by countries, in thousands of metric tons*[1]—Continued

Country[1]	1938	1939	1940	1941	1942	1943
Europe—Continued.						
Germany:						
Coal	186,177	200,000	(3)	(3)	[8] 139,000	(3)
Lignite	195,312	230,000	(3)	(3)	(3)	(3)
Austria:						
Coal	227	(2)	(3)	(3)	(3)	(3)
Lignite	3,342	(2)	(3)	(3)	(3)	(3)
Greece: Lignite	108	139	(3)	[4] 180	[4] 350	[4] 125
Hungary:						
Coal	1,042	1,107	1,207	(3)	[4] 1,500	(3)
Lignite	8,317	9,518	9,485	(3)	[4] 10,000	(3)
Italy:						
Coal	1,480	2,025	(3)	(3)	(3)	(3)
Lignite	873	1,058	(3)	(3)	(3)	(3)
Netherlands:						
Coal	13,488	12,861	(3)	(3)	(3)	(3)
Lignite	171	197	(3)	(3)	(3)	(3)
Poland:						
Coal	38,104	(2)	(3)	(3)	(3)	(3)
Lignite	10	(2)	(3)	(3)	(3)	(3)
Portugal:						
Coal	299	299	369	435	438	[9] 298
Lignite	15	35	64	84	108	[9] 79
Rumania:						
Coal	299	285	(3)	(3)	[4] 6,500	(3)
Lignite	2,097	2,300	(3)	(3)		
Spain:						
Coal	5,649	6,606	8,862	8,763	9,186	9,397
Lignite	166	194	569	793	1,117	1,126
Svalbard (Spitsbergen)	627	640	(3)	(3)	(3)	(3)
Sweden	431	444	498	583	(3)	(3)
Switzerland	3	3	8	(3)	(3)	(3)
United Kingdom:						
Great Britain	230,659	235,051	227,898	209,656	206,901	(3)
Northern Ireland	(10)	(2)	(3)	(3)	(3)	(3)
U. S. S. R.:						
Coal	98,627	(2)	148,700	(3)	[4] 247,000	(3)
Lignite			15,900			
Yugoslavia:						
Coal	450	444	[11] 3,170	7,310	[7] [11] 1,160	(3)
Lignite	5,287	5,622				
Asia:						
British Borneo	(10)	(10)	(3)	(3)	(3)	(3)
China (Free)	4,260	4,568	5,716	6,000	(3)	(3)
Manchuria	15,000	19,000	21,630	24,500	25,500	(3)
Chosen	3,200	4,481	(3)	(3)	(3)	(3)
Federated Malay States	486	448	794	(3)	(3)	(3)
India, British	28,798	28,214	[4] 26,000	[4] 26,000	(3)	(3)
Indochina:						
Coal	2,340	2,588	2,456	[7] 1,117	[7] 732	1,293
Lignite	4	27	30	(3)	(3)	(3)
Japan:						
Japan proper:						
Coal	(2)	(2)	(3)	(3)	(3)	(3)
Lignite	(2)	(2)	(3)	(3)	(3)	(3)
Karafuto	(2)	(2)	(3)	(3)	(3)	(3)
Taiwan	(2)	(2)	(3)	(3)	(3)	(3)
Netherlands Indies	1,457	1,781	2,009	[12] 778	(3)	(3)
Philippine Islands	41	47	(3)	(3)	(3)	(3)
Syria and Lebanon: Lignite	(10)	1	2	(3)	(3)	(3)
Turkey:						
Coal	2,589	2,696	3,006	3,020	2,511	[4] 3,200
Lignite	129	151	149	178	267	[4] 400
U. S. S. R.:						
Coal	34,261	(2)	(3)	(3)	(3)	(3)
Lignite						
Africa:						
Algeria	13	(2)	50	72	(3)	(3)
Belgian Congo: Coal	42	(2)	23	31	38	(3)
Madagascar	(3)	(3)	(3)	1	2	(3)
Morocco, French	123	116	143	145	[4] 110	(3)
Nigeria	368	311	313	(3)	(3)	(3)
Portuguese East Africa	10	8	20	(3)	(3)	15
Southern Rhodesia	1,044	1,118	[13] 1,257	[13] 1,399	[13] 1,487	[13] 1,713
Union of South Africa	16,284	16,890	17,176	20,430	20,900	(3)

See footnotes at end of table.

TABLE 66.—*World production of coal and lignite, 1938–43, by countries, in thousands of metric tons*[1]—Continued

Country[1]	1938	1939	1940	1941	1942	1943
Oceania:						
Australia:						
New South Wales	9,725	11,376	[14] 9,551	[14] 11,939	[14] 12,497	[14] 14,391
Queensland	1,131	1,339	(3)	(3)	(3)	
Tasmania	85	99	(3)	(3)	137	
Victoria:						
Coal	312	371	(3)	(3)	(3)	
Lignite	3,734	3,710	(3)	(3)	(3)	
Western Australia	614	566	548	(3)	(3)	
New Zealand:						
Coal	994	1,061	1,163	1,199	1,196	[15] 2,374
Lignite	1,264	1,319	1,393	1,483	1,529	
Total, all grades	1,469,000	1,639,000	(3)	(3)	(3)	(3)
Lignite (total of items shown above)	264,000	301,000	(3)	(3)	(3)	(3)
Bituminous and anthracite (by subtraction)	1,205,000	1,338,000	(3)	(3)	(3)	(3)

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[1] Coal is also mined in Argentina, Iran, and Italian East Africa, but production figures for these countries are not available.
[2] Estimate included in total.
[3] Data not yet available.
[4] Estimate.
[5] Bituminous coal.
[6] Estimated production of Slovakia only.
[7] January to June, inclusive.
[8] Estimated production of Ruhr only.
[9] January to September, inclusive.
[10] Production less than 1,000 tons.
[11] Estimated production of Croatia only.
[12] Production of Government mines only.
[13] Tonnage raised by the Wankie colliery for the year ended August 31 of year stated.
[14] Preliminary.
[15] January to October, inclusive.

PENNSYLVANIA ANTHRACITE

By J. A. Corgan, J. W. Buch, and M. I. Cooke

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REVIEW OF 1943

The heavy demand for anthracite continued throughout 1943, and the industry succeeded in producing more anthracite than in any year since 1930, despite loss in manpower, labor disturbances, floods, and difficulty in obtaining equipment and supplies. The output of 60,644,000 tons, however, was not sufficient to meet the demand created by shortages of other space-heating fuels, the requests from Canada for large tonnages, and the increased needs occasioned by the migration of great numbers of people into the highly industrialized New England and Middle Atlantic States. In January 1943 the operators and miners agreed to extend the work week from 5 to 6 days, thereby effecting a considerable increase in the production of anthracite for the year. In a further attempt to meet the demand during the 1943–44 winter, the miners worked 7 days a week in February 1944, and the additional tonnage obtained on the seventh day helped to alleviate the shortage.

From May 1 to October 12, 1943, all anthracite mines were operated under the control of the Federal Government because of unsettled labor conditions occasioned by the absence of a contract between the anthracite producers and the United Mine Workers of America to supersede the one that expired April 30. On November 1, for the same reason, the President issued a second order directing the Secretary of the Interior to take immediate possession of the mines. At the close of the year the mines were still operating under direction of the Government. The Bureau of Mines estimates that stoppages of work in the Pennsylvania anthracite mines in 1943 resulted in a production loss of 5,700,000 net tons. Had it not been for this loss, it is believed that the output of anthracite in 1943 would have met requirements.

The Bureau of Mines worked closely with the Solid Fuels Administration for War in compiling detailed statistical data relating to distribution, production, consumption, utilization, and market requirements for anthracite. The Solid Fuels Administration for War based its program for the equitable distribution of anthracite upon these statistics.

The output of anthracite from "bootleg" holes declined from 5,000,000 net tons in 1941 to 1,912,000 tons in 1943. The decline may be attributed largely to the efforts of the Anthracite Committee to eliminate this unlawful business, the induction of young men into the armed forces, and opportunities for employment in legitimate industry.

Anthracite Industries, Inc., through its laboratory at Primos, Pa., greatly expanded its program embracing fundamental product research and development work on new and improved equipment for burning anthracite.

Funds amounting to $450,000, which were authorized by an act of Congress (S. 357) for the erection of a research laboratory in the anthracite region, will not be available until hostilities cease. Investigations and researches to be conducted through facilities thus afforded will relate particularly to the mining, preparation, and utilization of anthracite and to safety, health, and sanitation in mining operations.

The Anthracite Tidewater Emergency Bureau, established at New York in May 1942 by anthracite producers, wholesalers, and railroads delivering at tidewater ports, continued to function effectively in 1943 in expediting car movement and in arranging for the use of tidewater facilities. The Bureau compiled statistics concerning cars of anthracite standing at tidewater piers and endeavored to bring about more efficient utilization of railroad equipment, boats, and barges engaged in transporting coal at tidewater.

Definition of Pennsylvania anthracite industry.—Based upon differences in composition and characteristics of the product, trade practice and historical usage recognize two major divisions in the coal industry of the United States—bituminous coal and Pennsylvania anthracite. Anthracite and semianthracite are mined also in parts of Virginia, Arkansas, and Colorado and in New Mexico. Locally these coals represent distinct and important industries, but the tonnages involved are small and for statistical convenience usually are grouped with the totals of the bituminous-coal industry.

The Pennsylvania anthracite industry, as here defined, includes all nonbituminous fields of that State. Trade usage commonly includes the output of the Bernice Basin in Sullivan County with Pennsylvania anthracite, although the coal of this basin is classified officially as semianthracite.

Statistical trends.—Tables 1 and 2 present pertinent statistical data on the Pennsylvania anthracite industry.

TABLE 1.—*Statistical trends of Pennsylvania anthracite industry, 1939–43*

	1939	1940	1941	1942	1943
Production:					
Loaded at mines for shipment:					
Breakers net tons	[1] 43,660,662	[1] 43,800,127	46,864,422	51,173,756	[1] 50,812,873
Washeries do	1,766,384	1,761,942	2,538,692	1,957,926	2,401,065
Dredges do	565,236	613,884	1,008,983	778,019	821,899
Sold to local trade and used by employees net tons	3,081,073	3,052,626	3,695,125	4,059,403	4,233,732
Used at collieries for power and heat net tons	2,414,022	2,256,061	2,261,045	2,358,625	2,374,051
Total production do	51,487,377	51,484,640	56,368,267	60,327,729	60,643,620
Value at breaker, washery, or dredge	$187,175,000	$205,490,000	$240,275,000	$271,673,000	$306,816,018
Average sales realization per net ton on breaker shipments:					
Domestic:					
Lump and Broken	$4.63	$5.49	$5.72	$6.03	$6.77
Egg	$4.73	$5.32	$5.84	$6.24	$6.96
Stove	$4.84	$5.47	$5.93	$6.26	$6.96
Chestnut	$4.87	$5.49	$5.93	$6.28	$6.97
Pea	$3.65	$4.13	$4.50	$4.85	$5.48
Total domestic	$4.64	$5.24	$5.68	$6.05	$6.76
Steam:					
Buckwheat No. 1	$2.90	$3.18	$3.37	$3.46	$4.00
Buckwheat No. 2 (Rice)	$2.20	$2.35	$2.52	$2.63	$3.12
Buckwheat No. 3 (Barley)	$1.62	$1.68	$1.78	$1.89	$2.25
Other, including Buckwheat No. 4	$0.91	$0.92	$1.02	$1.09	$1.42
Total steam	$2.25	$2.41	$2.55	$2.58	$3.02
Total all sizes	$3.85	$4.27	$4.59	$4.79	$5.38
Percent by sizes in total breaker shipments:					
Domestic:					
Lump and Broken	0.6	0.3	0.3	0.3	0.4
Egg	5.2	4.5	4.2	5.2	7.1
Stove	24.1	24.1	24.3	23.6	22.4
Chestnut	25.8	25.9	25.5	24.9	24.5
Pea	11.0	11.1	10.8	9.6	8.7
Total domestic	66.7	65.9	65.1	63.6	63.1
Steam:					
Buckwheat No. 1	14.3	14.7	14.6	14.5	14.2
Buckwheat No. 2 (Rice)	7.8	7.8	8.2	8.0	8.3
Buckwheat No. 3 (Barley)	8.5	8.8	8.9	9.6	9.9
Other, including Buckwheat No. 4	2.7	2.8	3.2	4.3	4.5
Total steam	33.3	34.1	34.9	36.4	36.9
Producers' stocks [2] net tons	994,000	939,000	1,274,000	798,000	329,000
Exports do	2,590,000	2,668,000	3,380,000	4,439,000	4,139,000
Imports do	298,000	135,000	75,000	140,000	166,000
Consumption (calculated) do	49,700,000	49,000,000	52,700,000	56,500,000	57,100,000
Average number of days worked	183	186	203	239	270
Man-days lost on account of strikes and lock-outs	241,688	176,432	397,616	279,641	(3)
Number of men on strike during year	27,795	19,464	39,768	26,631	(3)
Average number of men employed	93,138	91,313	88,054	82,121	79,153
Output per man per day net tons	3.02	3.02	3.04	2.95	2.78
Output per man per year do	553	562	617	705	751
Quantity cut by machines do	1,881,884	1,816,483	1,855,422	2,285,640	1,624,883
Quantity mined by stripping do	5,486,479	6,352,700	7,316,574	9,070,933	8,989,387
Quantity loaded by machines underground net tons	11,773,833	12,326,000	13,441,987	14,741,459	14,745,793
Distribution:					
Total receipts in New England [4] net tons	4,902,000	4,822,000	5,551,000	5,974,000	5,722,000
Exports to Canada do	2,577,000	2,627,000	3,361,000	4,418,000	4,097,000
Loaded into vessels at Lake Erie [5] net tons	531,000	430,000	536,000	575,000	661,000
Receipts at Duluth-Superior [6] do	202,000	138,000	253,000	222,000	302,000

[1] Includes small quantity of washery coal.
[2] Anthracite Committee.
[3] Data not available.
[4] Commonwealth of Massachusetts, Division on the Necessaries of Life, and Association of American Railroads.
[5] Ore and Coal Exchange, Cleveland, Ohio.
[6] U. S. Engineer Office, Duluth, Minn.

[All tonnage figures represent net tons]

	1943														1942 (total)
													Year		
	January	February	March	April	May	June	July	August	September	October	November	December	Total	Change from 1942 (percent)	
Production, including mine fuel, local sales, and dredge coal:															
Monthly total	4, 466, 000	5, 203, 000	5, 855, 000	5, 337, 000	5, 219, 000	3, 244, 000	5, 698, 000	5, 653, 000	5, 474, 000	5, 359, 000	4, 140, 000	4, 996, 000	60, 644, 000	+. 5	60, 328, 000
Shipments, breakers, and washeries only: [1]															
Monthly total, all sizes	3, 557, 317	4, 158, 131	4, 669, 828	4, 378, 407	4, 275, 678	2, 739, 101	4, 710, 077	4, 746, 455	4, 543, 871	4, 396, 199	3, 488, 706	4, 213, 888	49, 877, 658	−1. 3	50, 549, 769
Distribution:															
Lake Erie loadings [2]	--------	--------	2, 263	36, 449	68, 021	69, 529	75, 092	106, 428	103, 422	105, 917	85, 614	8, 194	660, 929	+14. 9	575, 176
Receipts at Duluth-Superior [3]	--------	--------	--------	--------	28, 973	26, 132	42, 298	60, 251	44, 583	59, 564	40, 286	--------	302, 087	+36. 2	221, 793
Upper Lake dock trade: [4]															
Receipts:															
Lake Superior	--------	--------	42	--------	15, 404	--------	8, 263	13, 066	21, 637	49, 398	34, 475	--------	142, 285	−12. 0	161, 731
Lake Michigan	5, 195	6, 721	5, 572	21, 938	49, 311	35, 857	7, 436	41, 651	49, 796	37, 225	52, 424	15, 767	328, 893	+16. 8	281, 502
Deliveries (reloadings):															
Lake Superior	9, 746	6, 354	8, 014	4, 629	5, 464	11, 531	3, 797	18, 919	24, 723	36, 124	13, 372	24, 616	167, 289	−27. 6	231, 218
Lake Michigan	27, 872	29, 122	26, 415	18, 911	26, 967	34, 776	27, 777	37, 780	43, 632	33, 446	22, 142	19, 988	348, 828	+7. 2	325, 370
New England receipts:															
By tide [5]	39, 426	34, 289	44, 800	29, 023	38, 802	28, 035	25, 582	31, 644	45, 254	27, 242	34, 382	32, 822	411, 301	−6. 8	441, 249
By rail [6]	379, 934	469, 484	502, 549	477, 680	429, 514	328, 911	401, 283	526, 299	501, 779	476, 716	332, 578	483, 664	5, 310, 391	−1. 5	5, 393, 475
Exports [7]	148, 486	325, 618	374, 183	371, 269	386, 882	281, 248	366, 855	463, 957	411, 456	408, 731	262, 716	337, 279	4, 138, 680	−6. 8	4, 438, 588
Imports [7]	8, 359	15, 906	26, 636	8, 985	44, 408	16, 131	12, 940	6, 375	--------	16, 790	9, 490	--------	166, 020	+18. 5	140, 115
Industrial consumption and stocks by:															
Railroads (class 1 only): [8]															
Consumption	120, 063	101, 724	126, 635	120, 840	101, 432	83, 790	76, 880	77, 624	81, 450	91, 667	97, 920	116, 033	1, 196, 058	−. 7	1, 203, 900
Stocks	192, 842	190, 174	200, 128	204, 478	201, 596	197, 369	183, 132	177, 724	183, 069	178, 726	176, 116	144, 168	144, 168	−26. 2	195, 419
Electric-power utilities: [9]															
Consumption	236, 718	235, 228	254, 058	242, 675	243, 110	266, 926	299, 035	319, 472	309, 933	300, 926	265, 163	296, 276	3, 269, 520	+16. 6	2, 805, 195
Stocks	1, 510, 528	1, 503, 953	1, 530, 054	1, 633, 802	1, 622, 930	1, 789, 692	1, 709, 999	1, 797, 106	1, 851, 977	1, 898, 873	1, 858, 790	1, 804, 663	1, 804, 663	+14. 3	1, 579, 064
Other industrial consumers [10] (selected representative plants):															
Stocks, end of month	465, 082	429, 510	435, 600	472, 876	434, 831	392, 703	1, 041, 581	1, 086, 673	1, 119, 373	796, 705	755, 910	1, 104, 734	1, 104, 734	--------	478, 461
Consumed during month	151, 635	130, 439	131, 443	122, 311	102, 201	91, 504	278, 103	228, 723	234, 804	186, 285	200, 201	276, 318	(11)	(11)	(11)

See footnotes at end of table.

TABLE 2.—*Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1943*—Continued

[All tonnage figures represent net tons]

	1943														1942 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Year		
													Total	Change from 1942 (percent-	
Supply, end of month..days..	95	92	103	116	132	129	116	147	143	133	113	124	....	....	....
Number of firms reporting....	82	80	86	85	85	79	839	775	830	611	611	617	617	....	75
Retail dealers [4] (selected representative plants):															
Stocks, end of month..........	174,813	173,396	155,579	117,950	138,996	110,715	334,470	358,327	354,879	194,596	197,757	97,070	97,070	....	348,057
Deliveries during month.......	258,194	254,779	331,578	296,441	240,082	230,290	601,115	711,658	746,106	368,208	266,748	250,820	([11])	([11])	3,372,099
Supply, end of month..days..	21	19	15	12	18	14	17	16	14	16	22	12	....	....	....
Number of dealers reporting..	108	108	123	118	129	125	2,509	2,540	2,518	1,479	1,478	1,081	1,081	....	159
Stocks on upper Lake docks: [4]															
Lake Superior...............	45,396	36,738	28,899	24,270	34,210	22,678	27,127	21,292	18,210	31,481	52,540	27,922	27,922	−49.4	55,145
Lake Michigan...............	83,176	60,775	39,932	42,959	65,303	66,384	46,181	50,052	56,216	59,995	90,277	86,056	86,056	−18.7	105,853
Producers stocks [12]............	542,303	378,554	215,864	173,068	172,712	185,857	196,162	247,371	344,184	403,979	363,797	328,837	328,837	−58.8	797,815
Prices at mines, average per net ton: [13]															
Company Stove..............	$7.19	$7.30	$7.30	$7.30	$7.30	$7.30	$7.30	$7.30	$7.30	$7.30	$7.46	$8.00	$7.36	+9.4	$6.73
Company Buckwheat No. 1.....	$4.11	$4.20	$4.20	$4.20	$4.20	$4.20	$4.20	$4.20	$4.20	$4.20	$4.34	$4.80	$4.25	+13.3	$3.75
Wholesale prices: [14]															
On tracks, destination:															
Chestnut......................	$10.66	$10.80	$10.81	$10.81	$10.89	$10.87	$10.87	$10.87	$10.87	$10.87	$10.96	$11.41	$10.89	+5.6	$10.31
Pea............................	$9.26	$9.40	$9.40	$9.40	$9.44	$9.43	$9.43	$9.43	$9.43	$9.43	$9.52	$9.97	$9.46	+6.3	$8.90
Index numbers (1926=100)......	88.5	89.7	89.8	89.8	89.7	89.5	89.6	89.6	89.9	89.9	90.6	95.0	90.4	+5.9	85.4
Labor conditions: [14]															
Average weekly earnings........	$31.25	$44.47	$43.84	$43.40	$37.39	$29.52	$39.69	$45.48	$43.73	$44.77	$28.02	$47.90	$39.96	+18.1	$33.85
Index of employment (1939 av.=100)................	83.4	89.5	89.4	88.8	87.3	86.5	86.2	84.9	84.5	84.0	82.9	84.0	86.0	−8.2	93.7
Index of pay-roll totals (1939 av.=100)................	101.5	154.9	152.7	150.2	127.1	99.3	133.1	150.6	144.2	146.5	90.4	156.6	133.9	+7.7	124.3

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[1] Furnished by Anthracite Institute.

[2] Ore and Coal Exchange, Cleveland, Ohio.

[3] U. S. Engineer Office, Duluth, Minn.

[4] Solid Fuels Administration for War, U. S. Department of the Interior.

[5] January-February, furnished by Commonwealth of Massachusetts, Division on the Necessaries of Life (figures are preliminary); March estimated; April-December, Anthracite Emergency Tidewater Bureau.

[6] Furnished by Commonwealth of Massachusetts. Division on the Necessaries of Life. Figures are preliminary.

[7] Department of Commerce.

[8] Association of American Railroads.

[9] Federal Power Commission.

[10] January-June, National Association of Purchasing Agents; July-December, Solid Fuels Administration for War, U. S. Department of the Interior.

[11] Data not available.

[12] Anthracite Committee. Represents coal in storage closest available date to the end of the month.

[13] Computed from weekly quotations from trade journals. Figures represent circular prices quoted on white ash by leading anthracite-producing companies.

[14] Bureau of Labor Statistics.

The war and anthracite.—Shortages of competitive fuels and migration of war workers into urban areas of the New England and Middle Atlantic States were responsible for the strong demand for Pennsylvania anthracite in those areas in 1943. In addition to increased requirements for space heating, large quantities were needed by railroads, utilities, industrial plants, and the United States armed forces. Although the industry could not meet requirements, it increased its output over 1942 by 0.5 percent despite the labor shortage, difficulty in obtaining equipment and supplies, and labor disturbances that were estimated to have cost the industry 5,700,000 tons of coal.

In addition to the increased demands in this country, the industry shipped large quantities of anthracite to Canada to substitute for other space-heating fuels, especially gas and oil, the use of which was restricted sharply in that country. Exports, virtually all of which went to Canada, increased from 2,668,000 net tons in 1940 to 4,439,000 tons in 1942. Exports in 1943 totaled 4,139,000 net tons. About 80 percent of the coal shipped to Canada consists of Pea and larger sizes; these sizes are used almost exclusively in Canada for space-heating purposes.

In April 1943 the President abolished the Office of Solid Fuels Coordinator for War by executive order and established within the United States Department of the Interior the Solid Fuels Administration for War, with the Secretary of the Interior as Administrator. This agency and its immediate predecessors were created to handle problems relating to the production, distribution, consumption, and utilization of both anthracite and bituminous coal. Early in 1943 it was apparent that unless available supplies of anthracite were distributed equitably serious area shortages would occur. As an aid to a distribution program the Bureau of Mines, in cooperation with industry representatives and the Solid Fuels Administration for War, collected data from producers and wholesalers of anthracite which showed in detail shipments of anthracite in the coal year April 1, 1942, to March 31, 1943, to destinations in the United States and Canada. From these data, the Solid Fuels Administration for War allocated anthracite to many localities to relieve area shortages.

The Bureau of Mines compiled detailed monthly statistics, also required by Solid Fuels Administration for War, from producers and wholesalers of anthracite.

Anthracite Committee.—The Anthracite Committee, representing operators whose production comprised a large part of the total output of the industry, was particularly active in matters requiring statistics on current production, employment, and other pertinent phases of the industry. Members of the committee represented the producers in various matters before the Office of Price Administration, Solid Fuels Administration for War, and other Government agencies. The committee kept in close contact with the illicit mining industry and made every effort to alleviate this unfavorable economic and social problem.

Anthracite Institute.—Representatives of the Anthracite Institute cooperated with producers of other solid fuels, representatives of the transportation industry, labor interests, and manufacturers of solid-fuels equipment in opposing the extension of natural-gas pipe lines into the principal anthracite markets. The institute expanded its information services considerably to keep the operators apprised of Government regulations, freight rates, State and Federal legislation, and many other pertinent matters of interest to the anthracite industry.

Sales of anthrafilt, the specially prepared anthracite sponsored by the Anthracite Institute and used for filtering, increased 44 percent for the first 9 months of 1943 compared with the same period in 1942. Anthrafilt is used extensively throughout the United States and many foreign countries in filtering boiler-plant water, in water used for swimming pools, and in municipal plants filtering water for drinking and other purposes. Many war plants and other closely allied industries are using anthrafilt in various filtering operations.

Anthracite Industries, Inc.—Anthracite Industries, Inc., with the largest personnel of coal scientists and technicians in its history, has enlarged its scope of research activities. A program conducted at its laboratory (Primos, Pa.) covers research and development work in the design of new anthracite-burning equipment and the development of auxiliary equipment to improve the efficiency and convenience of anthracite-burning equipment now in use. Manufacturers of coal-burning equipment and regulatory devices are encouraged to cooperate with the laboratory. With new and improved heating equipment, the anthracite industry will be in a more favorable position to compete successfully with other fuel industries in the post-war period. The expanded research activities are in addition to current work assisting real estate concerns, the plumbing trade, and Government agencies interested in the proper equipment and methods for burning anthracite.

Labor.—The labor disturbance that began late in December 1942, when 19,000 men went on strike in the Wyoming region, ended January 19, 1943, when the President ordered the miners to resume work. Details of this strike are given in Minerals Yearbook, 1942.

To meet increased demands for anthracite, the operators and miners agreed to extend the workday week from 5 to 6 days, contingent upon an increase of maximum prices of anthracite by the Office of Price Administration to compensate for increased costs occasioned by lengthening of the work week. The price increase of approximately 50 cents a ton was authorized, effective January 9, 1943, and within a few days the miners commenced the 6-day work week.

Representatives of the anthracite producers and United Mine Workers of America were unable to agree on terms of a contract to supersede the one that expired April 30, 1943. In the absence of an agreement the mine workers failed to report for work on May 1. To protect the interests of the Nation at war the President authorized and directed the Secretary of the Interior to take immediate possession of all anthracite mines in which a strike or stoppage occurred, together with all real and personal property, franchises, rights, facilities, funds, and other assets used in connection with operation of the mines and to operate or direct the operation of the mines in such manner as necessary for the successful prosecution of the war. In a radio address, May 2, the President requested that the miners report to work immediately. On May 4 the miners returned to work, and the producers and representatives of the workers agreed to an extension of the contract for a 15-day period ended May 18; on that date a further extension was made through May 31. On June 1 the miners again failed to report for work, returning at the request of the President on June 7, when another extension of the contract was made to

June 20. The mine workers, having again failed to report to work on June 20 when the contract extension expired, were instructed by their leaders to return to work on June 22 and to resume production under direction of the United States Government until midnight October 31, 1943; however, the mines did not swing into full production until July 5.

On October 12 the Federal Government released to private owners the anthracite mines remaining under Government control, taking possession of them again on November 1 in accordance with an order of the President who, in view of the failure of the miners to report to work on that date, directed the Secretary of the Interior to arrange a working agreement with the United Mine Workers of America. An agreement was reached November 3, 1943, and at the close of the year the mines were still operating under this agreement.

Research.—An act of Congress (S. 357) providing for the establishment and operation of a research laboratory in the Pennsylvania anthracite region was approved by the President December 18, 1942. The laboratory, to be established, equipped, and maintained by the Secretary of the Interior, acting through the Bureau of Mines, will be a center of information and assistance in matters pertaining to conserving resources; more efficient mining, preparation, and utilization of anthracite; the solution of economic problems; safety, health, and sanitation in mining operations; and other matters relating to problems of the anthracite industry. The act authorized an appropriation of $450,000 for the erection and equipment of the necessary buildings and $175,000 annually for the maintenance and operation of the experiment station.

The cooperative research program at the Pennsylvania State College, which has been financially supported for 4 years by the Commonwealth of Pennsylvania and the anthracite industry, was extended for a period ending May 31, 1945.

Research undertaken by Anthracite Industries, Inc., is discussed elsewhere in this chapter under the subheading Anthracite Industries, Inc.

Competitive fuels in the United States and principal markets.—The principal anthracite markets are the New England States, New York, New Jersey, Pennsylvania, Maryland, Delaware, and District of Columbia. Data on the consumption of all fuels in these markets are not available; however, the apparent consumption of anthracite, coke, briquets, and heating and range oils, in terms of anthracite, increased 2.7 percent in 1942 over 1941. Virtually all of the increase in consumption is attributable to increased shipments of anthracite to this area. In 1942 anthracite supplied 59.2 percent of the total equivalent fuels consumed in these States. In addition to the legitimate anthracite shipped, large quantities of illicit or "bootleg" coal are moved by truck to these States. The demand for metallurgical coke was largely responsible for the decline in domestic consumption of 28.7 percent in 1943 compared with 1940.

Details on consumption of competitive fuels are shown in table 3.

TABLE 3.—*Apparent consumption of anthracite and selected competitive fuels in the principal anthracite markets, 1940–43*

[Thousands of net tons]

Fuel	New England	New York	New Jersey	Delaware	Maryland	Pennsylvania	District of Columbia	Total: Thousands of net tons	Total: Percent of total fuels
Anthracite:									
All users: [1]									
1940	4,539	[2] 16,249	[2] 8,814	304	608	12,915	289	43,718	54.2
1941	5,440	[2] 16,308	[2] 10,190	361	681	14,103	283	47,466	56.0
1942	5,844	[2] 17,988	[2] 10,395	373	835	15,813	298	51,546	59.2
1943	5,604	[2] 18,555	[2] 9,527	362	873	16,540	320	51,781	(3)
Imports: [4]									
1940	135	-------	-------	-------	-------	-------	-------	135	.2
1941	75	-------	-------	-------	-------	-------	-------	75	.1
1942	140	1	-------	-------	-------	-------	-------	141	.2
1943	164	2	-------	-------	-------	-------	-------	166	(3)
Briquets:									
Domestic use:									
1940	52	26	1	(5)	2	10	(5)	91	.1
1941	52	25	1	(5)	3	14	(5)	95	.1
1942	54	26	1	(5)	4	22	(5)	107	.1
1943	53	31	2	(5)	4	27	1	118	(3)
Imports: [4]									
1940	-------	-------	-------	-------	-------	-------	-------	-------	-------
1941	-------	-------	-------	-------	-------	-------	-------	-------	-------
1942	-------	-------	-------	-------	-------	-------	-------	-------	-------
1943	-------	-------	-------	-------	-------	-------	-------	(5)	(3)
Coke:									
Domestic use:									
1940	1,430	1,564	489	2	28	537	2	4,052	5.0
1941	1,363	1,350	470	1	28	474	2	3,688	4.3
1942	1,252	1,064	408	2	13	428	2	3,169	3.6
1943	1,265	969	329	3	1	321	(5)	2,888	(3)
Imports: [4]									
1940	15	58	-------	-------	3	-------	-------	76	.1
1941	65	51	-------	-------	107	-------	-------	223	.3
1942	-------	56	-------	-------	-------	-------	-------	56	.1
1943	1	52	-------	-------	-------	-------	-------	53	(3)
Oil: Heating and range: [6]									
1940	13,027	10,726	4,503	120	885	2,704	578	32,543	40.4
1941	13,253	10,940	4,584	121	963	2,793	630	33,284	39.2
1942	11,875	10,659	4,890	158	1,061	2,817	651	32,111	36.8
1943	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total fuel: [7]									
1940	19,198	28,623	13,807	426	1,526	16,166	869	80,615	100.0
1941	20,348	28,674	15,245	483	1,782	17,384	915	84,831	100.0
1942	19,165	29,794	15,694	533	1,913	19,080	951	87,130	100.0
1943	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)

[1] Pennsylvania Department of Mines; illicit coal not included.
[2] An important but undetermined part of anthracite shown as shipped to New Jersey is reshipped New York City.
[3] Data not yet available.
[4] U. S. Department of Commerce.
[5] Less than 1,000 tons.
[6] Converted to coal equivalent upon basis of 4 barrels of fuel oil equaling 1 ton of coal.
[7] Excludes bituminous coal.

In general, the supplies of fuel commonly used for space heating in the United States increased in 1943 over 1942. Although the consumption of anthracite was not much greater than in 1942, it would have increased sharply had it not been for the curtailment of production caused by strikes and labor disturbances in the anthracite fields. Although the consumption of oil declined in some areas, an increase was shown for the United States as a whole. Details on supplies of various fuels are given in table 4.

TABLE 4.—*Total supplies of fuels commonly used for space-heating purposes in the United States, 1924 and 1940–43*

[Wherever available, figures represent quantity actually consumed for domestic heating or for space heating offices, apartments, hotels, schools, hospitals, etc. Where such figures are not available but where the fuel is known to be used chiefly for domestic or space-heating purposes, total production (or imports) is shown to indicate trend of growth]

	1924	1940	1941	1942	1943
SOLID FUELS (NET TONS)					
Anthracite:					
Production:					
Shipments of domestic sizes	56,576,296	29,076,573	30,912,649	32,924,518	32,563,787
Shipments of Buckwheat No. 1	9,510,508	6,771,387	7,357,542	7,789,168	7,537,642
Shipments of smaller steam sizes [1]	11,160,695	10,327,993	12,141,906	13,196,015	13,934,408
Local sales	3,043,939	3,052,626	3,695,125	4,059,403	4,233,732
Total commercial production	80,291,438	49,228,579	54,107,222	57,969,104	58,269,569
Exports	4,017,785	2,667,632	3,380,188	4,438,588	4,138,680
Imports for consumption (chiefly from United Kingdom and U. S. S. R.)	117,951	135,436	74,669	140,115	166,020
Fuel briquets [2]	580,508	1,027,585	1,258,129	1,644,755	1,989,223
Packaged-fuel production	----------	284,513	269,844	253,048	215,605
Coke:					
Byproduct sales for domestic use	2,812,771	8,131,947	6,596,969	5,963,474	4,784,090
Beehive sales for domestic use	139,886	99,066	85,990	98,220	101,438
Imports for consumption	82,833	112,550	267,886	108,782	98,127
Gas-house-coke sales [3]	1,400,000	(4)	(4)	533,882	577,931
Petroleum-coke production	761,100	1,526,600	1,648,800	1,338,400	1,399,200
Anthracite and semianthracite production outside of Pennsylvania	704,513	(4)	(4)	(4)	(4)
Lignite production [5]	2,255,385	2,939,201	2,775,832	2,930,661	(4)
Bituminous-coal sales for domestic use	(6)	(6)	(6)	(6)	(6)
OIL (BARRELS OF 42 GALLONS)					
Oil sales for heating buildings:					
Range oil	(4)	44,692,000	46,110,000	44,923,000	[7] 45,425,000
Heating oils:[8]					
Domestic	5,021,000	160,379,000	167,514,000	168,989,000	[7] 178,900,000
Commercial	(4)				
Liquefied petroleum gases, domestic	(4)	3,191,000	5,255,000	7,133,000	8,080,000
GAS (MILLION CUBIC FEET)					
Natural-gas consumption for domestic and commercial use [9]	285,152	578,290	586,911	682,140	[7] 745,000
Manufactured-gas sales for:[10]					
Domestic use	(4)	198,752	198,700	205,778	(11)
House heating	(4)	68,498	67,151	79,600	(11)

[1] A considerable part of the smaller steam sizes is used by industries, railroads, and public utilities.
[2] Production plus imports less exports.
[3] Partly estimated.
[4] Data not available.
[5] An estimated one-half is used for domestic purposes.
[6] Exact data not available; estimated between 55 and 77 million tons a year, including lignite. Anthracite and semianthracite outside Pennsylvania, shown separately.
[7] Estimated.
[8] Includes all grades of fuel oil used for heating buildings.
[9] Includes gas used for heating offices, hotels, apartments, schools, hospitals, and stores and other large buildings, as well as houses.
[10] American Gas Association.
[11] Data not yet available.

Transportation and distribution of anthracite to principal markets.—The Bureau of Mines, in cooperation with Solid Fuels Administration for War, canvassed shippers of Pennsylvania anthracite for detailed data showing the distribution of anthracite to ultimate destinations for the coal year 1942–43. The shipments were reported by method of movement (rail, truck, tidewater, and lake) and by kinds of consumers (retail dealers, railroads, utilities, United States Government, States, municipalities, and others). To a great extent the Solid Fuels Administration for War bases its procedure for distributing and allocating anthracite upon these statistics compiled by the Bureau of Mines.

Table 5 gives shipments of anthracite by States of destination, as reported by the producers and wholesalers. It will be noted from

TABLE 5.—*Shipments of Pennsylvania anthracite, Apr. 1, 1942, to Mar. 31, 1943, by States of destination, in net tons* [1]

State	Sizes				Total	Percent of grand total
	Broken, egg, stove, chestnut, and pea	Buckwheat No. 1	Rice	All others		
New England:						
Connecticut	1,285,479	124,770	65,649	49,467	1,525,365	2.58
Maine	347,297	28,791	9,651	671	386,410	.65
Massachusetts	2,656,205	196,449	116,456	79,128	3,048,238	5.16
New Hampshire	252,455	32,512	14,819	72,054	371,840	.63
Rhode Island	416,485	40,312	13,851	1,927	472,575	.80
Vermont	243,479	48,541	14,332	17,002	323,354	.55
Total New England	5,201,400	471,375	234,758	220,249	6,127,782	10.37
Middle Atlantic:						
New Jersey	5,009,849	1,229,685	803,290	1,834,785	8,877,609	15.03
New York	12,108,093	4,553,432	1,755,882	1,729,235	20,146,642	34.10
Pennsylvania (includes local sales)	7,440,992	1,576,851	1,731,035	5,001,812	15,750,690	26.66
Total Middle Atlantic	24,558,934	7,359,968	4,290,207	8,565,832	44,774,941	75.79
South Atlantic:						
Delaware	291,780	20,979	12,615	22,964	348,338	.59
District of Columbia	257,448	37,011	3,254	145	297,858	.51
Florida	1,625			53	1,678	(2)
Georgia	1,457			58	1,515	(2)
Maryland	679,442	145,939	13,386	45,151	883,918	1.50
North Carolina	2,628	261		172	3,061	.01
South Carolina	5,195			270	5,465	.01
Virginia	106,496	29,484	836	219	137,035	.23
West Virginia	210		50	14,099	14,359	.02
Total South Atlantic	1,346,281	233,674	30,141	83,131	1,693,227	2.87
North Central:						
Illinois	288,334	2,955	14,806	43,109	349,204	.59
Indiana	110,070	158	1,054	2,704	113,986	.19
Iowa	16,768	52	170	237	17,227	.03
Kansas and Missouri	9,327	314	44	8,516	18,201	.03
Michigan	251,490	6,987	23,786	2,427	284,690	.48
Minnesota	76,512	2,523	763	54,490	134,288	.23
Nebraska	3,473			16	3,489	.01
North Dakota	11,930	20			11,950	.02
Ohio	111,806	1,040	6,604	21,470	140,920	.24
South Dakota	18,787	78		3	18,868	.03
Wisconsin	357,379	35,591	1,934	34,902	429,806	.73
Total North Central	1,255,876	49,718	49,161	167,874	1,522,629	2.58
South Central:						
Alabama and Tennessee	429			289	718	(2)
Arkansas and Oklahoma				435	435	(2)
Kentucky	539			14,952	15,491	.03
Louisiana and Texas	239	113		999	1,351	(2)
Total South Central	1,207	113		16,675	17,995	.03
Mountain and Pacific:						
Montana	368			49	417	(2)
All other States [3]	180			128	308	(2)
Total Mountain and Pacific	548			177	725	(2)
Unknown destinations [4]	622,626	80,919	68,722	38,144	810,411	1.37
Total United States	32,986,872	8,195,767	4,672,989	9,092,082	54,947,710	93.01
Exports to Canada	3,305,256	379,702	312,655	130,184	4,127,797	6.99
Exports to other foreign countries				56	56	(2)
Grand total	36,292,128	8,575,469	4,985,644	9,222,322	59,075,563	100.00

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[1] As reported by producers and wholesalers on Solid Fuels Administration for War form SFA-6.
[2] Less than 0.01 percent.
[3] Includes California, Idaho, Nevada, Utah, Washington, and Wyoming.
[4] Coal sold to over-the-road truckers for which destinations were not reported.

this table that 86.16 percent of the total anthracite shipments was destined to the New England and Middle Atlantic States and that 1.37 percent (810,000 tons) was destined to unknown States. All of this coal shipped to unknown States moved by truck from the mines, and it is safe to assume that virtually all of it was destined to New York, New Jersey, and Pennsylvania. Thus shipments of anthracite to the New England and Middle Atlantic States approximated 88 percent of the total anthracite shipped to destinations in the United States and Canada during the coal year 1942–43.

According to data compiled from records of the Pennsylvania Department of Mines, shipments of anthracite, by truck, from mines to markets declined from 7,955,738 net tons in 1942 to 7,877,860 net tons in 1943. In 1942 and 1943 the trucked coal represented 15 and 14.7 percent, respectively, of the total anthracite shipments to destinations in the United States. The State figures represent legitimate coal and some anthracite from illicit or "bootleg" mines, nearly all of which is trucked to market; river coal dredged from the streams draining the anthracite region is not included. In 1943 Pennsylvania received 76 percent of the total trucked shipments, and New Jersey and New York followed with 11 and 9 percent, respectively, whereas in 1942 these three States received 71, 15, and 11 percent, respectively. Anthracite rail shipments by States of destinations for 1941–43 are shown in table 6 and truck movement by months for 1942–43 is given in table 7.

TABLE 6.—*Shipments of Pennsylvania anthracite, 1941–43, by States of destination in net tons* [1]

[Truck shipments excluded]

	1941	1942	1943
New England States	5, 539, 936	5, 843, 834	5, 603, 946
New York	15, 269, 752	17, 107, 566	17, 812, 425
New Jersey	8, 858, 652	9, 215, 932	8, 632, 278
Pennsylvania	9, 168, 068	10, 154, 459	10, 528, 699
Delaware	234, 454	265, 135	278, 539
Maryland	627, 936	746, 568	760, 497
District of Columbia	271, 921	283, 761	310, 782
Virginia	118, 805	126, 779	108, 764
Ohio	119, 710	113, 447	125, 117
Indiana	86, 809	98, 242	93, 215
Illinois	281, 548	303, 824	338, 196
Wisconsin	320, 500	394, 328	460, 020
Minnesota	75, 334	97, 416	179, 647
Michigan	247, 703	302, 160	298, 873
Other States	52, 223	81, 397	81, 650
Total United States	41, 273, 351	45, 134, 848	45, 612, 648
Canada	2, 907, 755	3, 730, 722	3, 600, 508
Other foreign countries	13, 061	6, 528	15, 711
Grand total	44, 194, 167	48, 872, 098	49, 228, 867

[1] Department of Mines, Harrisburg, Pa.

TABLE 7.—*Truck shipments of Pennsylvania anthracite by months in 1943, by States of destination, in net tons* [1]

Destination	January	February	March	April	May	June	July	August	September	October	November	December	Total	Percent of total trucked
Pennsylvania:														
Within region	355,089	363,857	387,410	353,940	261,701	145,712	255,185	335,069	396,331	341,473	270,367	431,952	3,898,086	49.5
Outside region	190,384	226,056	229,740	200,561	208,843	135,584	202,621	174,056	162,325	136,984	84,136	161,779	2,113,069	26.8
New York	42,821	89,247	72,783	67,296	79,869	43,245	65,144	68,907	62,261	58,022	29,042	64,305	742,942	9.4
New Jersey	73,356	77,465	82,209	75,779	78,372	54,865	83,060	87,557	85,252	75,974	48,473	72,331	894,693	11.4
Delaware	8,417	8,861	9,159	8,210	7,544	5,349	8,448	6,790	5,763	4,696	4,433	5,793	83,463	1.1
Maryland	5,481	15,092	12,354	9,728	12,609	5,688	11,065	10,038	8,904	8,200	1,056	12,617	112,832	1.4
District of Columbia	1,316	1,918	1,392	1,294	1,350	931	895		20	95			9,211	.1
Other States	2,369	3,150	1,886	1,286	1,607	766	1,706	1,885	2,233	2,403	1,636	2,637	23,564	.3
Total: 1943	679,233	785,646	796,933	718,094	651,895	392,140	628,124	684,302	723,089	627,847	439,143	751,414	7,877,860	100.0
1942	852,527	796,421	677,827	731,621	649,675	628,445	497,416	602,572	594,152	636,840	576,253	711,989	7,955,738	100.0

[1] Compiled from reports of Pennsylvania Department of Mines.

According to data compiled from records of the Commonwealth of Massachusetts, Division on the Necessaries of Life, and the Anthracite Emergency Tidewater Bureau, rail receipts of Pennsylvania anthracite in New England in 1943 declined 1.5 percent from 1942; tidewater receipts, 6.8 percent. Table 8 gives details of anthracite movement to New England. Loadings at Lake Erie ports increased 14.9 percent in 1943 over 1942; receipts at upper Lake docks, 6.3 percent.

TABLE 8.—*Receipts of anthracite in New England, 1917, 1920, 1923, and 1927–43, in thousands of net tons*

Year	Receipts by tide [1]						Receipts by rail [1]	Imports [2]	Total receipts of Pennsylvania anthracite [3]
	Maine	New Hampshire	Massachusetts	Rhode Island	Connecticut	Total			
1917	432	47	2,222	555	1,165	4,421	7,259	1	11,679
1920	307	6	2,015	450	743	3,521	7,804	1	11,324
1923	437	27	2,216	511	891	4,082	8,102	145	12,039
1927	242	33	1,220	311	615	2,421	6,725	106	9,040
1928	205	35	1,373	301	528	2,442	6,934	369	9,007
1929	237	17	1,227	329	450	2,260	6,781	483	8,558
1930	275	17	1,236	271	422	2,221	6,169	658	7,732
1931	164	18	1,125	282	348	1,937	5,125	611	6,451
1932	148	10	1,014	212	275	1,659	3,980	574	5,065
1933	195	7	1,027	202	259	1,690	3,562	443	4,809
1934	168	20	946	190	266	1,590	4,382	477	5,495
1935	121	7	802	205	237	1,372	4,030	559	4,843
1936	127	14	792	198	267	1,398	3,889	612	4,675
1937	81	11	604	152	200	1,048	3,713	395	4,366
1938	93	2	554	137	191	977	3,491	363	4,105
1939	74	3	488	83	227	875	4,027	298	4,604
1940	48	4	350	74	172	648	4,174	135	4,687
1941	57	9	348	58	210	682	4,870	75	5,477
1942	Not available					581	5,393	139	5,835
1943						575	5,310	164	5,721

[1] Commonwealth of Massachusetts, Division on the Necessaries of Life.
[2] U. S. Department of Commerce.
[3] Total receipts by rail and by tide less imports.

Figure 1 presents graphically shipments of anthracite from the Lehigh, Schuylkill, and Wyoming regions, 1850 to 1943, inclusive.

Consumption.—Consumption of anthracite in the United States in 1943, including colliery fuel, amounted to 57,100,000 net tons, an increase of 600,000 tons over the calculated consumption in 1942. These figures consider imports, exports, and changes in producers' stocks of anthracite but do not allow for changes in stocks held by retail dealers and small consumers, as data on changes of stocks in these groups were insufficient. Since there was a shortage of anthracite in 1943, stocks held by retail dealers no doubt declined to a very low level, and actual consumption probably was much higher than the figure mentioned. Electric-power utilities and class I railroads consumed 4,465,578 tons of anthracite in 1943 compared with 4,009,095 tons in 1942.

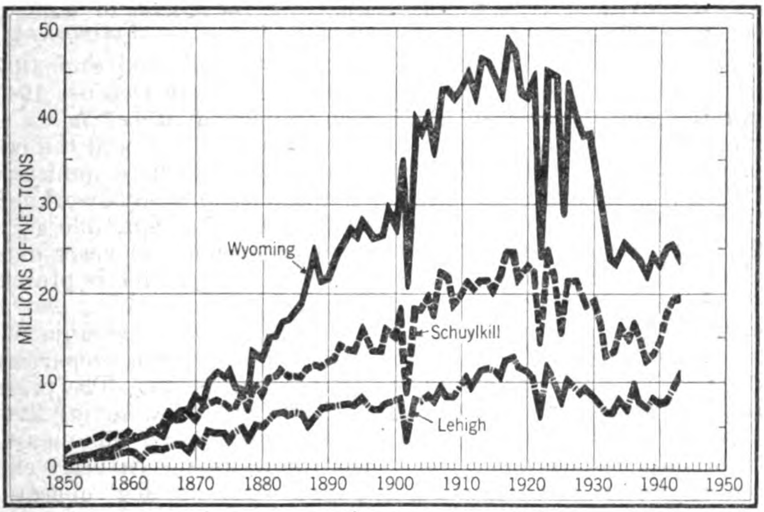

FIGURE 1.—Anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1850–1943.

Changes in stocks.—The great demand for anthracite in 1943, especially domestic sizes and Buckwheat No. 1, caused producers to draw heavily on their stocks, resulting in a decline of 58.8 percent from 1942. Virtually all of the coal in storage at the close of 1943 was Buckwheat No. 2 or smaller.

Stocks held by public utilities in 1943 increased 14.3 percent over 1942; however, stocks held by railroads (class I only) and upper Lake docks declined 26.2 and 29.2 percent, respectively.

Days' supply of anthracite held by retail dealers declined from 21 days in January 1943 to 12 days in December 1943.

Illicit coal.—The efforts of the Anthracite Committee to abolish "bootleg" mining of anthracite are evidently successful, as the output of anthracite by the illicit mining industry declined from 3,931,000 net tons in 1942 to 1,912,000 tons in 1943. The output in 1941 was estimated at 5,000,000 net tons.

The committee announced that, as of November 30, 1943, the industry would cease to purchase "bootleg" coal for preparation. The committee, in accordance with the provisions of Act of Assembly No. 125, approved July 7, 1941, adopted a resolution on October 15 which explained the situation, in part, as follows:

> Seventy-five percent of those formerly engaged in bootlegging have accepted employment in legitimate industry. The insistence of a minority in continuing to work as bootleggers and their refusal to accept employment in legitimate industry, of which there is ample evidence, is harmful to the war effort of the Nation. Their course lessens the tax revenues and the production of the Nation.
>
> The situations created by bootlegging are not limited to the money losses sustained by landowners whose coal has been unlawfully taken, or to the harm done to the Anthracite Industry and to the public by the marketing of an inferior fuel, or to the coal which has been irretrievably lost through the unsound mining practices of bootleggers. The greatest harm lies in the hazards to future deep mining, which bootleggers have created, and in the destruction of taxable wealth.

A survey by the committee in March 1941 indicated that 10,762 men were working 3,006 "bootleg" holes, whereas in October 1943 a comparable survey revealed 2,725 men employed in 791 holes. In March 1944 the number of holes had decreased to 652, and the number of men employed totaled 2,220. A survey by the committee in May 1942 revealed that 45 percent of the men and boys working in "bootleg" holes were less than 30 years old. A comparable survey in March 1944 indicated that the percentage under 30 years of age had declined to 28 percent. A large part of this decline is probably due to the younger men entering the armed forces.

Early in 1943 a bill was introduced before the Pennsylvania State Legislature requiring inspections, by the Pennsylvania Department of Mines, of all openings employing two or more men. The present law requires periodic inspection only of those mines employing five or more men. The legislature adjourned without passing this measure; had it become law, it would have been the means of virtually eliminating the illicit mining industry, as most of the "bootleg" operations would have experienced difficulty in meeting the safety standards maintained by the legitimate industry.

Trend of employment.—The number of employees in the anthracite industry continued to decrease in 1943. At the close of the year a shortage of several thousand men below the number necessary to meet production requirements existed within the industry. Employment dropped from an average of 88,054 men in 1941 to 82,121 men in 1942 and 79,153 men in 1943. The greater part of the decline occurred among underground miners and their laborers. The induction of men into the armed forces and the loss of others to nearby war industries were largely responsible for the decrease. These employment figures do not include men working in "bootleg" holes. Data on employment are given in tables 22 and 23.

Sales realization.—The average realization on breaker shipments increased from $4.79 a net ton in 1942 to $5.38 in 1943—an increase of 12.3 percent. The average value per net ton of the total anthracite production in 1943 was $5.06 compared with $4.50 in 1942.

Trend in prices.—Anthracite f. o. b. mine prices were increased substantially in 1943 because of added production costs. Effective January 9, 1943, the Office of Price Administration authorized an increase in maximum prices of anthracite of approximately 50 cents a net ton. The price increase reflected higher production costs incident to extension of the work week from 5 to 6 days, and the payment of time and a half and rate and a half for the sixth consecutive day worked in any 1 week. The new prices as of January 9, 1943, were $7.30 per net ton f. o. b. mine for Broken, Egg, Stove, and Chestnut sizes; $5.75 for Pea; and $4.20, $3.35, and $2.50 for Buckwheat No. 1, Rice, and Barley sizes, respectively.

When the miners failed to report for work on November 1, 1943, the Federal Government took possession of the anthracite mines, and the Secretary of the Interior in his official capacity as Coal Mines Administrator reached an agreement with the United Mine Workers on November 3. To compensate the anthracite producers for increased labor costs allowable under the Little Steel formula and the agreement of November 3, the Office of Price Administration authorized, effective November 24, an average increase in anthracite f. o. b. mine prices of about 62 cents a net ton. The new prices were as follows: Broken, Egg, Stove, and Chestnut sizes, $8.00 a net ton; Pea, $6.45; Buckwheat No. 1, $4.80; Rice, $3.85; Barley, $2.85; and smaller than Barley size, $2.15 a ton. On June 1, 1944, the new f. o. b. mine prices were reduced an average of 14 cents a ton leaving an increase of 48 cents a net ton. The larger increases up to June 1, 1944, are to permit the producers to recover the amount of labor costs made retroactive to May 1, 1943, by the War Labor Board.

On January 29, 1944, the Solid Fuels Administrator for War directed the Federal operating managers of the anthracite mines to give the miners an opportunity to work four Sundays in February to increase the output of anthracite. To compensate the anthracite producers for added costs of production for the month of February by reason of four consecutive 7-day weeks the Office of Price Administration authorized an increase of 45 cents a net ton in the f. o. b. mine prices of anthracite for all coal loaded at the preparation plants for shipment during the month of February. Thus the maximum February prices were: Broken, Egg, Stove, and Chestnut, $8.45; Pea, $6.90; Buckwheat No. 1, $5.25; Rice, $4.30; and Barley, $3.30 a net ton, respectively. On March 1, 1944, the mine prices reverted to those in effect in January 1944.

Retail prices of anthracite, bituminous coal, coke, and heating oils in selected cities, by months, in 1943 are shown in table 9. These prices were compiled from reports of the Bureau of Labor Statistics United States Department of Labor.

TABLE 9.—*Retail prices of selected fuels, 1943, by cities and months*[1]

[Coal and coke are per net ton and heating oil, per 100 gallons]

City and fuel	January	February	March	April	May	June	July	August	September	October	November	December
Baltimore, Md.												
Anthracite:												
Stove	$12.48	$12.64	$12.64	$12.63	$12.63	$12.60	$12.60	$12.60	$12.59	$12.59	$12.59	$13.20
Buckwheat No. 1	9.66	9.80	9.80	9.79	9.79	9.77	9.77	9.76	9.76	9.72	9.74	10.26
Bituminous coal: Low-Volatile Stove	10.53	10.54	10.71	10.71	10.69	10.69	10.69	10.69	10.62	10.54	10.52	10.79
Coke: Egg	12.54	12.79	12.77	12.77	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Heating oil:												
Fuel oil No. 2	8.95	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Fuel oil No. 3	------	------	------	------	------	------	------	------	------	------	------	------
Boston, Mass.												
Anthracite:												
Stove	15.16	15.13	15.13	15.13	15.13	15.09	15.08	15.08	15.08	15.09	15.09	15.79
Buckwheat No. 1	11.57	11.54	11.53	11.53	11.53	11.49	11.48	11.48	11.48	11.49	11.49	12.09
Bituminous coal: Low-Volatile Stove	------	------	------	------	------	------	------	------	------	------	------	------
Coke: Egg	14.32	14.29	14.29	14.29	14.29	14.29	14.29	14.29	14.29	14.29	14.29	14.29
Heating oil:												
Fuel oil No. 2	9.07	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Fuel oil No. 3	9.16	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Buffalo, N. Y.												
Anthracite:												
Stove	13.02	13.02	13.02	13.02	13.02	12.97	12.97	12.97	12.97	12.97	12.97	13.67
Buckwheat No. 1	9.26	9.26	9.26	9.26	9.26	9.22	9.22	9.22	9.22	9.22	9.22	9.82
Bituminous coal: Low-Volatile Stove	------	------	------	------	------	------	------	------	------	------	------	------
Coke: Egg	11.00	11.00	10.89	10.89	10.89	10.89	10.89	10.89	10.89	10.89	10.89	10.89
Heating oil:												
Fuel oil No. 2	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Fuel oil No. 3	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Chicago, Ill.[4]												
Anthracite:												
Stove	16.07	16.17	16.18	16.18	16.18	16.14	16.13	16.13	16.13	16.14	16.14	16.84
Buckwheat No. 1	12.91	12.95	12.96	12.96	12.96	12.91	12.91	12.91	12.91	12.91	12.91	13.54
Bituminous coal: Low-Volatile Stove	12.03	12.06	12.15	12.17	12.17	12.13	12.12	12.12	12.13	12.13	12.13	12.41
Coke: Egg	13.87	13.93	13.91	13.91	13.91	13.90	13.90	13.90	13.90	13.90	13.90	14.47
Heating oil:												
Fuel oil No. 2	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96
Fuel oil No. 3	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96
Milwaukee, Wis.												
Anthracite:												
Stove	14.25	14.25	14.30	14.73	14.85	14.81	14.81	14.81	14.81	14.81	14.81	15.28
Buckwheat No. 1	11.25	11.25	11.25	11.50	11.70	11.72	11.72	11.72	11.72	11.72	11.72	12.10
Bituminous coal: Low-Volatile Stove	11.81	11.81	11.98	12.15	12.94	12.92	12.92	12.92	12.92	12.92	12.92	13.00
Coke: Egg	12.44	12.44	12.45	11.79	12.47	12.48	12.49	12.49	12.49	12.49	12.49	13.29
Heating oil:												
Fuel oil No. 2	7.94	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Fuel oil No. 3	7.94	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

New York, N. Y.[4]												
Anthracite:												
Stove	13.24	13.21	13.16	13.16	13.16	13.17	13.12	13.12	13.12	13.14	13.43	14.13
Buckwheat No. 1	9.11	9.08	9.10	9.10	9.10	9.11	9.06	9.06	9.06	9.06	9.37	9.90
Bituminous coal: Low-Volatile Stove	----	----	----	----	----	----	----	----	----	----	----	----
Coke: Egg	13.20	13.20	13.22	13.22	13.22	13.22	13.22	13.22	13.22	13.22	13.22	13.22
Heating oil:												
Fuel oil No. 2	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Fuel oil No. 3	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Philadelphia, Pa.												
Anthracite:												
Stove	12.22	12.35	12.36	12.36	12.38	12.34	12.34	12.34	12.34	12.34	12.34	13.04
Buckwheat No. 1	8.94	9.03	9.03	9.03	9.02	9.00	8.99	8.99	8.99	8.99	8.99	9.59
Bituminous coal: Low-Volatile Stove	----	----	----	----	----	----	----	----	----	----	----	----
Coke: Egg	11.77	11.78	11.79	11.79	11.79	11.79	11.79	11.78	11.78	11.79	11.79	11.79
Heating oil:												
Fuel oil No. 2	9.00	9.00	9.00	9.00	8.98	8.98	8.98	8.98	8.98	8.98	8.98	8.98
Fuel oil No. 3	9.00	9.00	9.00	9.00	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97
Portland, Maine.												
Anthracite:												
Stove	14.96	15.14	15.14	15.14	15.14	15.09	15.09	15.09	15.09	15.09	15.09	15.78
Buckwheat No. 1	11.14	11.29	11.29	11.29	11.29	11.24	11.24	11.24	11.24	11.24	11.24	11.83
Bituminous coal: Low-Volatile Stove	----	----	----	----	----	----	----	----	----	----	----	----
Coke: Egg	13.27	13.33	14.24	14.24	14.24	14.19	14.19	14.19	14.19	14.19	14.19	14.19
Heating oil:												
Fuel oil No. 2	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Fuel oil No. 3	----	----	----	----	----	----	----	----	----	----	----	----
Washington, D. C.[6]												
Anthracite:												
Stove	14.41	14.41	14.42	14.42	14.42	14.34	14.34	14.34	14.34	14.34	14.34	15.05
Buckwheat No. 1	10.60	10.60	10.60	10.60	10.60	10.49	10.49	10.49	10.49	10.49	10.49	11.19
Bituminous coal: Low-Volatile Stove	11.69	11.70	11.83	11.83	11.83	11.84	11.84	11.84	11.84	11.84	11.84	12.11
Coke: Egg	12.59	12.66	13.09	13.09	13.09	13.04	13.04	13.04	13.04	13.04	13.04	13.04
Heating oil:												
Fuel oil No. 2	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40
Fuel oil No. 3	----	----	----	----	----	----	----	----	----	----	----	----

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[1] Compiled from reports of Bureau of Labor Statistics, U. S. Department of Labor. Prices are as of the 15th of each month. Data are preliminary.

[2] Not available.

[3] Insufficient data.

[4] Includes 2-percent sales tax.

[5] Includes 1-percent sales tax.

[6] Prices of coal per ton of 2,240 pounds.

Imports and exports.—In 1943 almost all exports of anthracite were destined to Canada, where continued restrictions on the use of heating oils and gas for domestic purposes and a shortage of coke created a great demand for Pennsylvania anthracite. In 1943 exports of anthracite declined 6.8 percent from 1942, whereas imports increased 18.5 percent. For details on exports and imports see tables 30 and 31.

Mechanical stokers and oil burners.—According to the Bureau of the Census, United States Department of Commerce, factory sales of class 1 mechanical stokers (capacity under 61 pounds of coal per hour) declined from 17,110 in 1941 to 11,562 in 1942 and in 1943 totaled only 472 units; sales of class 2 stokers (capacity, 61 to 100 pounds of coal per hour) totaled 599 units in 1941, declined to 356 in 1942, and then increased to 2,043 units in 1943. Shipments of oil burners for central heating plants and industrial use totaled 303,869 units in 1941, declined to 131,031 units in 1942, and fell in 1943 to 72,563 units. Government restrictions on the manufacture and installation of stokers and oil burners were largely responsible for the general decline in the sales of this equipment in 1943.

POST-WAR OUTLOOK

The position of anthracite in relation to other competitive fuels in the post-war period will depend largely on steps taken during the war and immediately after to develop low-cost, automatic burning equipment; to find new uses for anthracite; and to establish new production methods that will reduce mining costs. The establishment and operation of a research laboratory in the anthracite region as provided by act of Congress (S. 357) and the expanded research program of Anthracite Industries, Inc., will be of considerable value to the industry in the post-war period. Research provisions contained in S. 357 are discussed elsewhere in this chapter under the subheading Research; activities of Anthracite Industries, Inc., are covered in detail under subheading Anthracite Industries, Inc.

SOURCES AND ACKNOWLEDGMENTS

Final statistics of the Pennsylvania anthracite-mining industry are prepared from an annual canvass, by mail, of the producers and shippers of anthracite. About 95 percent of the tonnage is reported direct, and the remaining 5 percent is collected by personal visits or from reliable collateral evidence. The data on individual operations are furnished voluntarily by the producers and treated confidentially, as is customary in the statistical services of the Bureau of Mines.

In assembling available detailed information, free use has been made of the pertinent figures prepared by the Anthracite Institute, the Anthracite Committee, the Association of American Railroads, and the Pennsylvania Department of Mines; to all of these thanks are extended for their cordial and continued cooperation. Thanks are also due especially to the producers for reporting so promptly and so fully upon their 1943 operations.

PRODUCTION

The production statistics of the Pennsylvania anthracite industry contained in this chapter include coal from five sources—deep mines, strip pits, culm banks, "bootleg" mines, and rivers. A small quantity of semianthracite produced in Sullivan County (97,720 net tons in 1943) is also included for historical comparison. The total production from these sources in 1943 was 60,644,000 net tons, a gain of 316,000 net tons over the 1942 output of 60,328,000 net tons.

See tables 10 to 18 for production and shipments by regions, fields, and counties.

Before 1941 "bootleg" coal was not included in the production statistics of the Pennsylvania anthracite industry by the Bureau of Mines; however, in 1941 the Anthracite Committee inaugurated a plan whereby legitimate operators purchased lawfully the run-of-mine output of "bootleg" holes for preparation at their plants and shipment to market. In 1942 these shipments totaled 2,616,839 net tons; in 1943 the purchases were 1,265,617 tons. It would be impossible to segregate this purchased "bootleg" coal from the output of the legitimate industry. For this reason, it is included in the various production tables in the Minerals Yearbook chapters on Pennsylvania anthracite for 1941–43. The production statistics for those years, therefore, are not exactly comparable with previous years. No attempt has been made to include in the statistics "bootleg" coal other than that purchased by legitimate operators. To compute the output per man per day for the anthracite industry in 1941–43 it was necessary to deduct the "bootleg" purchases from the total tonnage shipped by the legitimate industry since adequate data on man-hours required to produce the "bootleg" tonnage are not available. Details of this procedure are discussed in this chapter under Labor Statistics.

Weeks and months.—Tables 10 and 11 summarize the statistics of weekly and monthly production of anthracite. Statistics of current output are estimated from records of car loadings and from tonnage

TABLE 10.—*Estimated weekly production of Pennsylvania anthracite in 1943, in net tons*

Week ended—	Net tons	Week ended—	Net tons
Jan. 2	[1] 52,000	July 17	1,345,000
9	927,000	24	1,333,000
16	1,051,000	31	1,384,000
23	1,077,000	Aug. 7	1,309,000
30	1,359,000	14	1,334,000
Feb. 6	1,380,000	21	1,259,000
13	1,373,000	28	1,303,000
20	1,164,000	Sept. 4	1,260,000
27	1,286,000	11	1,196,000
Mar. 6	1,250,000	18	1,270,000
13	1,299,000	25	1,306,000
20	1,228,000	Oct. 2	1,290,000
27	1,347,000	9	1,320,000
Apr. 3	1,348,000	16	1,301,000
10	1,337,000	23	1,297,000
17	1,342,000	30	1,041,000
24	1,115,000	Nov. 6	147,000
May 1	983,000	13	1,090,000
8	1,037,000	20	1,213,000
15	1,394,000	27	1,268,000
22	1,289,000	Dec. 4	1,237,000
29	1,353,000	11	1,221,000
June 5	136,000	18	1,135,000
12	1,324,000	25	934,000
19	1,352,000	31	[1] 891,000
26	286,000		
July 3	626,000	Calendar year	60,644,000
10	1,245,000		

[1] Figures represent output of working days in that part of week included in the calendar year 1943. Preliminary production for week of January 1, 1944, was 896,000 tons. Revised total for Jan. 2, 1943, was 801,000.

reports from trade sources. The weekly and monthly figures have been adjusted to the annual total ascertained by direct canvass of the operators.

TABLE 11.—*Estimated monthly production of Pennsylvania anthracite, 1936–43, in thousands of net tons* [1]

Month	1936	1937	1938	1939	1940	1941 [2]	1942 [2]	1943 [2]
January	5, 315	4, 236	4, 978	5, 019	5, 783	5, 162	4, 560	4, 466
February	6, 952	3, 671	3, 646	4, 169	3, 648	4, 596	4, 801	5, 203
March	3, 051	4, 795	4, 257	3, 652	3, 881	4, 765	5, 116	5, 855
April	4, 757	6, 779	3, 149	5, 367	3, 853	3, 317	5, 185	5, 337
May	5, 104	4, 361	4, 400	5, 141	4, 070	4, 001	4, 873	5, 219
June	4, 292	4, 635	4, 450	3, 577	4, 492	5, 072	5, 153	3, 244
July	3, 912	2, 748	2, 580	2, 951	4, 534	4, 855	5, 374	5, 698
August	3, 492	2, 903	2, 735	3, 883	3, 883	5, 441	5, 212	5, 653
September	3, 861	3, 682	3, 388	4, 840	4, 172	5, 334	5, 459	5, 474
October	4, 593	4, 848	4, 180	4, 985	4, 355	5, 580	5, 132	5, 359
November	4, 320	4, 439	3, 803	3, 989	3, 980	3, 974	4, 824	4, 140
December	4, 931	4, 759	4, 533	3, 914	4, 834	4, 271	4, 639	4, 996
	54, 580	51, 856	46, 099	51, 487	51, 485	56, 368	60, 328	60, 644

[1] Production is estimated from weekly carloadings as reported by the Association of American Railroads and includes mine fuel, coal sold locally, and dredge coal. Monthly statistics from 1905 to 1925 will be found in Mineral Resources, 1925, pt. II, pp. 427–428, and from 1925 to 1930 in Mineral Resources, 1930, pt. II, p. 741.

[2] Includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

Reconciliation of fresh-mined, culm-bank, and breaker product.—Anthracite is now produced from three sources—mines, culm banks, and rivers that drain the anthracite region. As all three sources contribute to the country's supply, it is important to consider them all to ascertain the total production. No difficulty is experienced in separating the figures of production by dredges, as this is a distinct industry. It is difficult, however, to make a sharp differentiation between fresh-mined and culm-bank coal, continuity of which may be maintained in the statistical history of the industry.

As the best solution of this problem, the individual breaker, washery, or dredge is taken as the unit in compiling the statistics, and the producing companies are asked to supply separate statements for each. These are totaled to form the primary tables of this report to show the total quantity of breaker product, washery product, and dredge product, with related figures of value and number of employees.

The figures for breaker and washery product, however, are not exactly equivalent to the fresh-mined and culm-bank coal because of the practice sometimes adopted of putting culm-bank coal through a breaker, either directly from the bank or after preliminary treatment in a washery. The tonnage of culm-bank coal prepared at the breakers is broken down by fields and shown in table 17.

Small mines and intercompany sales.—In recent years conditions have favored the development of numerous small mines operating on lease or subcontract and producing run-of-mine coal, which is sold to larger companies for preparation at a breaker. (This refers to legitimate mines only and does not concern illicit or "bootleg" mines.) At the same time, an increasing transfer of coal from one operation to another has developed, and some of the companies have built central breakers to which coal from numerous mines is shipped by rail or truck for preparation. These developments have increased the complexity of the task of collecting and compiling statistics of the industry. Great care has been exercised, however, to avoid double counting of tonnages produced by one operator and prepared for market by another, and the figures herein represent the net quantity of merchantable coal plus the fuel used by the collieries themselves. The employees of operators producing run-of-mine coal only have been included in the employment statistics, as they have received wages from the industry and have contributed to the final product.

Regions, fields, and counties.—The anthracite fields are divided into three trade regions—Lehigh, Schuylkill, and Wyoming. This classification is generally used by the trade, and it is also followed in the district organization of the United Mine Workers of America, in which district 1 corresponds to the Wyoming region, district 7 to the Lehigh region, and district 9 to the Schuylkill region. Geologically the anthracite area is classified by fields—the Northern, Eastern Middle, Western Middle, and Southern. This classification is used in technical operating studies because it follows more closely the geologic conditions that largely influence the methods and cost of mining. The Northern field is the same as the Wyoming region; the Eastern Middle field and that part of the Southern field lying east of Tamaqua (known as the Panther Creek Valley) make up the Lehigh region; the Schuylkill region comprises that part of the Southern field lying west of Tamaqua and the Western Middle field. For historical comparison, the tonnage of the small Bernice Basin is often included with the statistics of the Northern field, although the coal is classified officially as semianthracite. The total area of the four fields is about 484 square miles—the Northern covers 176 square miles, the Eastern Middle 33, the Western Middle 94, and the Southern 181.

Based upon minable reserves the Southern field is first, followed by the Western Middle, Northern, and Eastern Middle.

Tables 12 to 19 present production data by regions, fields, and counties.

TABLE 12.—*Pennsylvania anthracite shipped, sold locally, and used as colliery fuel in 1943, by regions*

Region	Shipments		Local sales		Colliery fuel		Total	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Lehigh:								
Breakers	10,441,379	$53,674,549	379,027	$2,292,208	336,077	$834,052	11,156,483	$56,800,809
Washeries	337,788	1,268,251	27,137	111,637	2,490	7,931	367,415	1,387,819
Dredges	37,452	60,037	-----	-----	-----	-----	37,452	60,037
Total Lehigh	10,816,619	55,002,837	406,164	2,403,845	338,567	841,983	11,561,350	58,248,665
Schuylkill:								
Breakers	16,944,126	83,840,041	804,151	4,076,173	333,179	612,759	18,081,456	88,528,973
Washeries	1,639,354	4,719,241	89,427	280,758	27,582	63,198	1,756,363	5,063,197
Dredges	771,697	1,088,878	508,408	798,239	4,430	5,749	1,284,535	1,892,866
Total Schuylkill	19,355,177	89,648,160	1,401,986	5,155,170	365,191	681,706	21,122,354	95,485,036
Wyoming:								
Breakers	23,329,648	135,359,349	[3] 2,425,582	[3] 13,346,024	1,662,195	2,611,330	27,417,425	151,316,703
Washeries	423,923	1,338,249	(3)	(3)	8,098	18,948	432,021	1,357,197
Dredges	12,750	19,874	-----	-----	-----	-----	12,750	19,874
Total Wyoming	23,766,321	136,717,472	2,425,582	13,346,024	1,670,293	2,630,278	27,862,196	152,693,774
Total, excluding Sullivan County:								
Breakers	50,715,153	272,873,939	[3] 3,608,760	[3] 19,714,405	2,331,451	4,058,141	56,655,364	296,646,485
Washeries	2,401,065	7,325,741	[3] 116,564	[3] 392,395	38,170	90,077	2,555,799	7,808,213
Dredges	821,899	1,168,789	508,408	798,239	4,430	5,749	1,334,737	1,972,777
Total	53,938,117	281,368,469	4,233,732	20,905,039	2,374,051	4,153,967	60,545,900	306,427,475
Sullivan County: [2] **Breakers**	97,720	388,543	-----	-----	-----	-----	97,720	388,543
Grand total: 1943	54,035,837	281,757,012	4,233,732	20,905,039	2,374,051	4,153,967	60,643,620	306,816,018
1942	53,909,701	250,965,000	4,059,403	17,006,000	2,358,625	3,702,000	60,327,729	271,673,000
Change, 1943 ......percent	+.2	+12.3	+4.3	+22.9	+.7	+12.2	+.5	+12.9

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[1] Value given is value at which coal left possession of producing company; does not include margins of separately incorporated sales companies.

[2] For purposes of historical comparison and statistical convenience, the mines of Sullivan County are grouped with the Pennsylvania anthracite region, although the product is classified as semianthracite according to the American Society for Testing Materials Tentative Standard.

[3] A small quantity of washery coal included with breaker.

TABLE 13.—*Pennsylvania anthracite produced, 1939–43, by fields, in net tons*

[The figures of breaker product include a certain quantity of culm-bank coal, which amounted to 5,027,899 tons in 1943. Data for 1913–25 will be found in Mineral Resources, 1925, pt. II, p. 517, and for 1919–30 in Mineral Resources 1930, pt. II, p. 747]

Field	1939	1940	1941	1942	1943
Eastern Middle:					
Breakers	[1] 5, 444, 335	[1] 5, 104, 708	5, 066, 892	5, 717, 908	6, 140. 224
Washeries	(1)	(1)	217, 642	259, 378	356, 450
Dredges	----------	----------	5, 032	----------	----------
Total, Eastern Middle	5, 444, 335	5, 104, 708	5, 289, 566	5, 977, 286	6, 496, 674
Western Middle:					
Breakers	9, 242 223	10, 168, 142	11, 531, 105	13, 122, 774	12, 577, 769
Washeries	906, 992	734, 541	946, 794	333, 089	280, 525
Dredges	253, 819	447, 760	531, 129	466, 339	442, 608
Total, Western Middle	10, 403, 034	11, 350, 443	13, 009, 028	13, 922, 202	13, 300, 902
Southern:					
Breakers	6, 196, 051	6, 615, 347	7, 445, 528	8, 797, 539	10, 519, 946
Washeries	855, 659	812, 162	1, 116, 438	1, 326, 087	1, 486, 803
Dredges	432, 974	492, 684	975, 457	794, 627	879, 379
Total, Southern	7, 484, 684	7, 920, 193	9, 537, 423	10, 918, 253	12, 886, 128
Northern:					
Breakers	27, 806, 467	26, 571, 383	28, 097, 833	29, 269, 471	[1] 27, 417, 425
Washeries	295, 103	484, 569	391, 452	168, 237	[1] 432, 021
Dredges	17, 067	2, 500	5, 945	24, 067	12, 750
Total, Northern	28, 118, 637	27, 058, 452	28, 495, 230	29, 461, 775	27, 862, 196
Total, excluding Sullivan County:					
Breakers	[1] 48, 689, 076	[1] 48, 459, 580	52, 141, 358	56, 907, 692	[1] 56, 655, 364
Washeries	[1] 2, 057, 754	[1] 2, 031, 272	2, 672, 326	2, 086, 791	[1] 2, 555, 799
Dredges	703, 860	942, 944	1, 517, 563	1, 285, 033	1, 334, 737
Total	51, 450, 690	51, 433, 796	56, 331, 247	60, 279, 516	60, 545, 900
Sullivan County: Breakers	36, 687	50, 844	37, 020	48, 213	97, 720
Grand total	51, 487, 377	51, 484, 640	56, 368, 267	60, 327, 729	60, 643, 620

[1] Small quantity of washery coal included with breaker.

TABLE 14.—*Pennsylvania anthracite produced in 1943, by counties*

County	Total shipments		Sold to local trade		Used for power		Total production	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Carbon	3, 733, 990	$19, 382, 714	88, 609	$512, 220	113, 523	$279, 329	3, 936, 122	$20, 174, 263
Columbia	787, 819	4, 140, 590	29, 519	95, 985	47, 603	90, 426	864, 941	4, 327, 001
Dauphin	214, 903	569, 360	323, 317	638, 949	4, 026	7, 287	542, 246	1, 215, 596
Lackawanna	7, 180, 304	39, 786, 204	1, 011, 898	5, 711, 173	406, 241	756, 562	8, 598, 443	46, 253, 939
Luzerne	20, 476, 250	118, 008, 902	1, 666, 216	9, 164, 214	1, 425, 764	2, 262, 748	23, 568, 230	129, 435, 864
Northumberland	5, 431, 015	25, 525, 758	277, 167	1, 319, 022	53, 602	91, 528	5, 761, 784	26, 936, 308
Schuylkill	15, 933, 182	73, 387, 488	666, 255	3, 223, 292	315, 468	649, 645	16, 914, 905	77, 260, 425
Sullivan	97, 720	388, 543	----------	----------	----------	----------	97, 720	388, 543
Susquehanna and Wayne	126, 556	496, 522	3, 304	19, 754	7, 824	16, 442	137, 684	532, 718
Berks, Lancaster, Lebanon, Northampton, and Snyder [2]	54, 098	70, 931	167, 447	220, 430	----------	----------	221, 545	291, 361
Total	54, 035, 837	281, 757, 012	4, 233, 732	20, 905, 039	2, 374, 051	4, 153, 967	60, 643, 620	306, 816, 018

[1] Value given for shipments in value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

[2] Counties producing dredge coal only.

TABLE 15.—*Pennsylvania anthracite produced in 1943, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, by regions, in net tons*

Region and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand-loaded				
Lehigh:						
Breakers	775,033	6,572,223	2,232,595	1,576,632	----------	11,156,483
Washeries	----------	----------	----------	367,415	----------	367,415
Dredges	----------	----------	----------	----------	37,452	37,452
Total, Lehigh	775,033	6,572,223	2,232,595	1,944,047	37,452	11,561,350
Schuylkill:						
Breakers	2,105,381	7,762,735	5,391,786	2,821,554	----------	18,081,456
Washeries	----------	----------	----------	1,756,363	----------	1,756,363
Dredges	----------	----------	----------	----------	1,284,535	1,284,535
Total, Schuylkil	2,105,381	7,762,735	5,391,786	4,577,917	1,284,535	21,122,354
Wyoming:						
Breakers	11,865,379	13,589,717	1,352,509	[1] 609,820	----------	[1] 27,417,425
Washeries	----------	----------	----------	[1] 432,021	----------	[1] 432,021
Dredges	----------	----------	----------	----------	12,750	12,750
Total, Wyoming	11,865,379	13,589,717	1,352,509	1,041,841	12,750	27,862,196
Total, excluding Sullivan County:						
Breakers	14,745,793	27,924,675	8,976,890	[1] 5,008,006	----------	[1] 56,655,364
Washeries	----------	----------	----------	[1] 2,555,799	----------	[1] 2,555,799
Dredges	----------	----------	----------	----------	1,334,737	1,334,737
Total	14,745,793	27,924,675	8,976,890	7,563,805	1,334,737	60,545,900
Sullivan County: Breakers	----------	65,330	12,497	19,893	----------	97,720
Grand total	14,745,793	27,990,005	8,989,387	7,583,698	1,334,737	60,643,620

[1] A small quantity of washery coal included with breaker.

TABLE 16.—*Pennsylvania anthracite produced in 1943, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, by fields, in net tons*

Field and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand loaded				
Eastern Middle:						
Breakers	775,033	3,188,574	1,088,969	1,087,648		6,140,224
Washeries				356,450		356,450
Dredges						
Total Eastern Middle	775,033	3,188,574	1,088,969	1,444,098		6,496,674
Western Middle:						
Breakers	1,835,463	6,027,746	2,612,436	2,102,124		12,577,769
Washeries				280,525		280,525
Dredges					442,608	442,608
Total Western Middle	1,835,463	6,027,746	2,612,436	2,382,649	442,608	13,300,902
Southern:						
Breakers	269,918	5,118,638	3,922,976	1,208,414		10,519,946
Washeries				1,486,803		1,486,803
Dredges					879,379	879,379
Total Southern	269,918	5,118,638	3,922,976	2,695,217	879,379	12,886,128
Northern:						
Breakers	11,865,379	13,589,717	1,352,509	[1] 609,820		[1] 27,417,425
Washeries				[1] 432,021		[1] 432,021
Dredges					12,750	12,750
Total Northern	11,865,379	13,589,717	1,352,509	1,041,841	12,750	27,862,196
Total, excluding Sullivan County:						
Breakers	14,745,793	27,924,675	8,976,890	[1] 5,008,006		[1] 56,655,364
Washeries				[1] 2,555,799		[1] 2,555,799
Dredges					1,334,737	1,334,737
Total	14,745,793	27,924,675	8,976,890	7,563,805	1,334,737	60,545,900
Sullivan County: Breakers		65,330	12,497	19,893		97,720
Grand total	14,745,793	27,990,005	8,989,387	7,583,698	1,334,737	60,643,620

[1] Small quantity of washery coal included with breaker.

Culm-bank coal.—The culm banks in the anthracite region have been a source of coal for many years. In the early days of anthracite mining, the smaller sizes of anthracite, especially Pea and under, were not used as they are today, and these sizes and larger pieces of refuse containing much good coal were piled in large banks throughout the region. In recent years, with the increased demand for the smaller sizes and more efficient preparation methods, the product of these banks is run through the washery or breaker, and a prepared coal is obtained.

In 1942 this source supplied 4,735,064 net tons of coal. Prepared coal from culm banks in 1943 amounted to 7,583,698 tons. Tables 15 to 17 give a detailed break-down of culm-bank product by regions and fields.

TABLE 17.—*Culm-bank coal put through breakers, 1939–43, by fields, in net tons*

Year	Northern	Eastern Middle	Western Middle	Southern	Total
1939	70,000	17,000	204,000	295,000	586,000
1940	13,000	[1] 139,000	250,000	362,000	764,000
1941	113,000	57,000	519,000	387,000	1,076,000
1942	291,000	420,000	1,413,000	524,000	2,648,000
1943	[1 2] 630,000	1,088,000	2,102,000	1,208,000	[1] 5,028,000

[1] Includes some washery coal.

[2] A small quantity of culm-bank coal was put through breakers in Sullivan County.

TABLE 18.—*Pennsylvania anthracite shipped in 1943, by regions and sizes*

Size	Breaker shipments [1]						Washery shipments	Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total				
					Excluding Sullivan County	Including Sullivan County			
Net tons									
Lump [2] and Broken	73, 955	78, 132	57, 068		209, 155	209, 155			209, 155
Egg	639, 182	972, 112	1, 989, 490		3, 600, 784	3, 600, 784	1, 414		3, 602, 198
Stove	2, 046, 996	2, 896, 865	6, 431, 657	12, 099	11, 375, 518	11, 387, 617	71, 483		11, 459, 100
Chestnut	2, 293, 563	3, 556, 791	6, 564, 413	20, 187	12, 414, 767	12, 434, 954	315, 099		12, 750, 053
Pea	991, 521	1, 653, 669	1, 761, 213	21, 757	4, 406, 403	4, 428, 160	115, 121	(5)	4, 543, 281
Total domestic sizes	6, 045, 217	9, 157, 569	16, 803, 841	54, 043	32, 006, 627	32, 060, 670	503, 117		32, 563, 787
Buckwheat No. 1	1, 538, 061	2, 667, 677	2, 985, 979	10, 588	7, 191, 717	7, 202, 305	308, 265	[3] 27, 072	7, 537, 642
Buckwheat No. 2 (Rice)	970, 064	1, 714, 990	1, 523, 980		4, 209, 034	4, 209, 034	316, 476	41, 456	4, 566, 966
Buckwheat No. 3 (Barley)	1, 192, 564	2, 292, 532	1, 543, 774		5, 028, 870	5, 028, 870	468, 137	188, 944	5, 685, 951
Buckwheat No. 4	262, 871	950, 026	307, 030		1, 519, 927	1, 519, 927	[4] 628, 670	401, 963	2, 550, 560
Other (including silt)	432, 602	161, 332	165, 044	33, 089	758, 978	792, 067	[4] 176, 400	162, 464	1, 130, 931
Total steam sizes	4, 396, 162	7, 786, 557	6, 525, 807	43, 677	18, 708, 526	18, 752, 203	1, 897, 948	821, 899	21, 472, 050
Grand total	10, 441, 379	16, 944, 126	23, 329, 648	97, 720	50, 715, 153	50, 812, 873	2, 401, 065	821, 899	54, 035, 837
Value									
Lump [2] and Broken	$501, 228	$533, 650	$381, 704		$1, 416, 582	$1, 416, 582			$1, 416, 582
Egg	4, 483, 370	6, 775, 820	13, 796, 885		25, 056, 075	25, 056, 075	$10, 211		25, 066, 286
Stove	14, 313, 548	20, 242, 787	44, 685, 565	$68, 091	79, 241, 900	79, 309, 991	461, 180		79, 771, 171
Chestnut	16, 060, 076	24, 863, 196	45, 609, 833	111, 279	86, 533, 105	86, 644, 384	2, 020, 032		88, 664, 416
Pea	5, 438, 152	9, 058, 986	9, 657, 800	105, 451	24, 154, 938	24, 260, 389	590, 222	(5)	24, 850, 611
Total domestic	40, 796, 374	61, 474, 439	114, 131, 787	284, 821	216, 402, 600	216, 687, 421	3, 081, 645		219, 769, 066
Buckwheat No. 1	6, 154, 719	10, 554, 971	12, 058, 726	41, 284	28, 768, 416	28, 809, 700	1, 162, 785	[3] 98, 818	30, 071, 303
Buckwheat No. 2 (Rice)	3, 035, 346	5, 227, 730	4, 884, 916		13, 147, 992	13, 147, 992	930, 289	101, 830	14, 180, 111
Buckwheat No. 3 (Barley)	2, 698, 160	5, 011, 928	3, 624, 051		11, 334, 139	11, 334, 139	1, 040, 474	294, 964	12, 669, 577
Buckwheat No. 4	445, 321	1, 422, 485	494, 047		2, 361, 853	2, 361, 853	[4] 885, 574	486, 051	3, 733, 478
Other (including silt)	544, 629	148, 488	165, 822	62, 438	858, 939	921, 377	[4] 224, 974	187, 126	1, 333, 477
Total steam	12, 878, 175	22, 365, 602	21, 227, 562	103, 722	56, 471, 339	56, 575, 061	4, 244, 096	1, 168, 789	61, 987, 946
Grand total	53, 674, 549	83, 840, 041	135, 359, 349	388, 543	272, 873, 939	273, 262, 482	7, 325, 741	1, 168, 789	281, 757, 012

Lump[2] and Broken	6.78	6.83	6.69		6.77	6.77			6.77
Egg	7.01	6.97	6.93		6.96	6.96	7.22		6.96
Stove	6.99	6.99	6.95	5.63	6.97	6.96	6.45		6.96
Chestnut	7.00	6.99	6.95	5.51	6.97	6.97	6.41		6.95
Pea	5.48	5.48	5.48	4.85	5.48	5.48	5.13	(3)	5.47
Total domestic	6.75	6.71	6.79	5.27	6.76	6.76	6.13		6.75
Buckwheat No. 1	4.00	3.96	4.04	3.90	4.00	4.00	3.77	[3] 3.65	3.99
Buckwheat No. 2 (Rice)	3.13	3.05	3.21		3.12	3.12	2.94	2.46	3.10
Buckwheat No. 3 (Barley)	2.26	2.19	2.35		2.25	2.25	2.22	1.56	2.23
Buckwheat No. 4	1.69	1.50	1.61		1.55	1.55	[4] 1.41	1.21	1.46
Other (including silt)	1.26	.92	1.00	1.89	1.13	1.16	[4] 1.28	1.15	1.18
Total steam	2.93	2.87	3.25	2.37	3.02	3.02	2.24	1.42	2.89
Grand total	5.14	4.95	5.80	3.98	5.38	5.38	3.05	1.42	5.21

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[1] Figures of shipments from breakers include some culm bank coal handled in the breakers.

[2] Quantity of Lump included is insignificant.

[3] A small amount of Pea included in Buckwheat No. 1.

[4] A small amount of Other included in Buckwheat No. 4.

Interregional variation in sizes.—The relative yield of domestic and steam sizes of anthracite in the three regions is greatly affected by geologic conditions, mining methods, and the quantity of culm-bank coal recovered.

In 1943, the breaker output of the Wyoming region consisted of 72 percent domestic and 28 percent steam sizes; the Lehigh region, 57.9 percent domestic and 42.1 percent steam sizes; the Schuylkill region, 54 percent domestic and 46 percent steam sizes. Table 18 shows shipments of anthracite by regions and sizes. Table 19 shows the percentages, by regions, of various sizes in relation to total breaker product.

TABLE 19.—*Sizes of Pennsylvania anthracite shipped from breakers, 1941–43, by regions, in percent of total*

[Note that shipments of dredge and washery coal are not included]

Size	Percent of total shipments								
	Lehigh region			Schuylkill region			Wyoming region		
	1941	1942	1943	1941	1942	1943	1941	1942	1943
Lump [1] and Broken	0.5	0.6	0.7	0.5	0.2	0.5	0.1	0.2	0.2
Egg	3.5	4.3	6.1	3.6	4.2	5.7	4.7	6.1	8.5
Stove	23.1	21.7	19.6	19.5	18.1	17.1	27.6	27.9	27.6
Chestnut	24.1	23.6	22.0	22.7	21.4	21.0	27.7	27.8	28.1
Pea	11.6	10.6	9.5	11.4	10.4	9.7	10.1	8.7	7.6
Total domestic	62.8	60.8	57.9	57.7	54.3	54.0	70.2	70.7	72.0
Buckwheat No. 1	15.4	14.6	14.7	16.3	16.3	15.8	13.4	13.2	12.8
Buckwheat No. 2 (Rice)	8.4	8.6	9.3	9.7	10.2	10.1	7.2	6.4	6.6
Buckwheat No. 3 (Barley)	8.9	9.9	11.4	11.4	12.8	13.5	7.4	7.4	6.6
Other, including Buckwheat No. 4 and Silt	4.5	6.1	6.7	4.9	6.4	6.6	1.8	2.3	2.0
Total steam	37.2	39.2	42.1	42.3	45.7	46.0	29.8	29.3	28.0

Size	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken	......	2.3	......	0.3	0.3	0.4	0.3	0.3	0.4
Egg	......	......	......	4.1	5.2	7.1	4.2	5.2	7.1
Stove	5.3	9.7	12.4	24.4	23.6	22.4	24.3	23.6	22.4
Chestnut	14.7	28.1	20.6	25.5	24.9	24.5	25.5	24.9	24.5
Pea	11.9	29.0	22.3	10.8	9.6	8.7	10.8	9.6	8.7
Total domestic	31.9	69.1	55.3	65.1	63.6	63.1	65.1	63.6	63.1
Buckwheat No. 1	3.7	21.2	10.8	14.6	14.5	14.2	14.6	14.5	14.2
Buckwheat No. 2 (Rice)	......	......	......	8.2	8.0	8.3	8.2	8.0	8.3
Buckwheat No. 3 (Barley)	7.4	......	......	8.9	9.6	9.9	8.9	9.6	9.9
Other, including Buckwheat No. 4 and Silt	57.0	9.7	33.9	3.2	4.3	4.5	3.2	4.3	4.5
Total steam	68.1	30.9	44.7	34.9	36.4	36.9	34.9	36.4	36.9

[1] Quantity of Lump included is insignificant.

AVERAGE VALUE AND SALES REALIZATION

The valuation figures in this study represent value at the breaker or washery reported by the operating companies. The company is requested to "estimate value of the product not sold" and to "exclude selling expenses" in making its report.

From this it will be seen that when a producing concern sells its output to a separately organized sales company the value reported will exclude the margin of the sales company and may therefore be somewhat less than the circular price at which the coal is placed on the general market. This fact should be borne in mind in considering the variations in value among different regions, shown in the tables, for the same sizes of coal.

The average sales realization per net ton on breaker shipments was $5.38 in 1943 compared with $4.79 in 1942—a 12.3-percent increase (see table 20).

With the inclusion of local sales, colliery fuel, washery coal, and dredge coal the average value per net ton of the total 1943 production is $5.06 compared with $4.50 in 1942 (see table 21).

TABLE 20.—*Average sales realization per net ton on Pennsylvania anthracite shipments from breakers, 1941–43, by regions and sizes*

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region			Schuylkill region			Wyoming region		
	1941	1942	1943	1941	1942	1943	1941	1942	1943
Lump[1] and Broken	$5.61	$5.92	$6.78	$5.82	$6.22	$6.83	$5.61	$6.01	$6.69
Egg	5.79	6.33	7.01	5.84	6.21	6.97	5.85	6.23	6.93
Stove	5.92	6.33	6.99	5.94	6.24	6.99	5.93	6.26	6.95
Chestnut	5.95	6.36	7.00	5.88	6.26	6.99	5.94	6.27	6.95
Pea	4.53	4.91	5.48	4.45	4.80	5.48	4.52	4.86	5.48
Total domestic	5.67	6.09	6.75	5.61	5.97	6.71	5.72	6.09	6.79
Buckwheat No. 1	3.36	3.50	4.00	3.34	3.40	3.96	3.40	3.49	4.04
Buckwheat No. 2 (Rice)	2.54	2.69	3.13	2.43	2.53	3.05	2.59	2.71	3.21
Buckwheat No. 3 (Barley)	1.84	1.97	2.26	1.67	1.80	2.19	1.85	1.96	2.35
Total steam	2.53	2.57	2.93	2.42	2.43	2.87	2.67	2.75	3.25
Total all sizes	4.50	4.71	5.14	4.26	4.35	4.95	4.82	5.11	5.80

Size	Sullivan County			Total—					
				Excluding Sullivan County			Including Sullivan County		
Lump[1] and Broken	------	$3.38	------	$5.72	$6.04	$6.77	$5.72	$6.03	$6.77
Egg	------	------	------	5.84	6.24	6.96	5.84	6.24	6.96
Stove	$4.09	4.05	$5.63	5.93	6.26	6.97	5.93	6.26	6.96
Chestnut	3.69	4.04	5.51	5.93	6.28	6.97	5.93	6.28	6.97
Pea	2.73	3.10	4.85	4.50	4.85	5.48	4.50	4.85	5.48
Total domestic	3.40	3.62	5.27	5.68	6.05	6.76	5.68	6.05	6.76
Buckwheat No. 1	1.45	2.40	3.90	3.37	3.46	4.00	3.37	3.46	4.00
Buckwheat No. 2 (Rice)	------	------	------	2.52	2.63	3.12	2.52	2.63	3.12
Buckwheat No. 3 (Barley)	.73	------	------	1.78	1.89	2.25	1.78	1.89	2.25
Total steam	.95	1.77	2.37	2.55	2.58	3.02	2.55	2.58	3.02
Total all sizes	1.73	3.05	3.98	4.59	4.79	5.38	4.59	4.79	5.38

[1] Quantity of Lump included is insignificant.

TABLE 21.—*Average value per net ton of Pennsylvania anthracite shipments, local sales, colliery fuel, and total production, 1942–43, by regions* [1]

[Note that values in this table include washery and dredge coal]

Region	1942				1943			
	Shipments	Local sales	Colliery fuel	Total production	Shipments	Local sales	Colliery fuel	Total production
Lehigh	$4.67	$5.24	$2.20	$4.60	$5.09	$5.92	$2.49	$5.04
Schuylkill	4.08	2.84	1.84	3.96	4.63	3.68	1.87	4.52
Wyoming	5.09	4.72	1.37	4.85	5.75	5.50	1.57	5.48
Total, excluding Sullivan County	4.66	4.19	1.57	4.50	5.22	4.94	1.75	5.06
Sullivan County	3.05	3.15	.96	3.05	3.98			3.98
Grand total	4.66	4.19	1.57	4.50	5.21	4.94	1.75	5.06

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[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

LABOR STATISTICS

A labor shortage of several thousand men characterized the Pennsylvania anthracite industry in 1943, when the average number of men employed was 79,153—a decrease of 2,968 from the total of 82,121 men employed in 1942. Many men formerly employed in the anthracite mines entered the armed forces, and others obtained employment in nearby war industries.

The employment statistics in this chapter do not include workers in "bootleg" or illicit coal mining, which is conducted in the Southern and Western Middle fields of the Pennsylvania anthracite regions. According to the Anthracite Committee, 7,554 men were working 2,029 "bootleg" holes in May 1942, and in March 1944 a comparable survey revealed 2,220 men employed in 652 holes. Although these workers are not included in the employment data, the coal produced by some of them was purchased by the legitimate industry for preparation and shipment to market, and coal so purchased is included in the production tables of this chapter. Complete employment data for the "bootleg" holes from which this coal was produced are not available. In calculating the output per man per day, therefore, the tons of "bootleg" coal purchased by the legitimate industry were deducted from the total tonnage reported by the operators, and the resulting legitimate production was then used to calculate the output per man per day. It is true that part of the time of the men employed at the preparation plants of the legitimate companies was used to prepare this purchased coal for market; however, on a per-ton basis this time is insignificant, and its omission will not detract materially from the validity of the result obtained.

See tables 22 and 23 for details on labor statistics.

TABLE 22.—*Men employed and days worked at operations producing Pennsylvania anthracite in 1943, by regions*[1]

[Includes operations of strip contractors]

Region	Average number of men employed								Average number of days plant operated	Man-days of labor	Average tons per man per day
	Underground			Surface				Grand total			
	Miners and their laborers	Other	Total underground	In strip pits	In preparation plant	Other	Total surface				
Lehigh:											
Breaker	5,395	3,894	9,289	1,136	905	2,963	5,004	14,293	270	3,851,997	2.90
Washery					40	113	153	153	256	39,236	[2] 9.36
Dredge					4	8	12	12	196	2,346	15.96
Total Lehigh	5,395	3,894	9,289	1,136	949	3,084	5,169	14,458	269	3,893,579	2.97
Schuylkill:											
Breaker	7,877	4,432	12,309	3,185	1,929	3,435	8,549	20,858	259	5,412,581	[3] 3.12
Washery					302	665	967	967	199	192,787	[2] [3] 8.79
Dredge					119	278	397	397	242	96,054	13.37
Total Schuylkill	7,877	4,432	12,309	3,185	2,350	4,378	9,913	22,222	257	5,701,422	3.48
Wyoming:											
Breaker	20,659	11,876	32,535	740	2,209	6,730	9,679	42,214	277	11,709,495	2.34
Washery					12	88	100	100	252	25,244	[2] 17.13
Dredge					5	3	8	8	288	2,304	5.53
Total Wyoming	20,659	11,876	32,535	740	2,226	6,821	9,787	42,322	277	11,737,043	2.37
Total, excluding Sullivan County:											
Breaker	33,931	20,202	54,133	5,061	5,043	13,128	23,232	77,365	271	20,974,073	[3] 2.64
Washery					354	866	1,220	1,220	211	257,267	[2] [3] 9.70
Dredge					128	289	417	417	241	100,704	13.25
Total	33,931	20,202	54,133	5,061	5,525	14,283	24,869	79,002	270	21,332,044	[3] 2.78
Sullivan County: Breaker	57	16	73	23	29	26	78	151	203	30,670	3.19
Grand total	33,988	20,218	54,206	5,084	5,554	14,309	24,947	79,153	270	21,362,714	[3] 2.78

[1] Men employed in "bootleg" operations excluded.

[2] Represents washeries for which both production and employment were separately reported.

[3] Output per man per day calculated on legitimate tonnages only; "bootleg" purchases excluded.

TABLE 23.—*Men employed at operations producing Pennsylvania anthracite, 1942–43, by counties*

[Includes operations of strip contractors]

County	Men		County	Men	
	1942	1943		1942	1943
Carbon	4,887	4,997	Snyder, Susquehanna, and Wayne	74	109
Columbia	1,004	963			
Dauphin and Lebanon	[1] 603	171	Berks, Lancaster, Northampton, Perry, and York [2]	95	[3] 64
Lackawanna	14,162	12,855			
Luzerne	38,868	35,467			
Northumberland	6,413	6,546			
Schuylkill	15,918	17,830		82,121	79,153
Sullivan	97	151			

[1] None in Lebanon in 1942.

[2] Counties producing dredge coal only.

[3] None in Perry and York in 1943.

EQUIPMENT AND METHODS OF MINING

Mechanical loading.—The percentage of total deep-mined production of anthracite loaded mechanically continued to increase. In 1943 the 14,746,000 tons so loaded comprised 34.5 percent of the total underground output compared with 32.6 percent (14,741,000 tons) in 1942 and 30.6 percent (13,442,000 tons) in 1941 (see tables 24 to 26).

Mechanical loading has increased more rapidly in the Northern field than in the other three anthracite-producing districts. The reason for this is that the coal measures in the Northern field are more

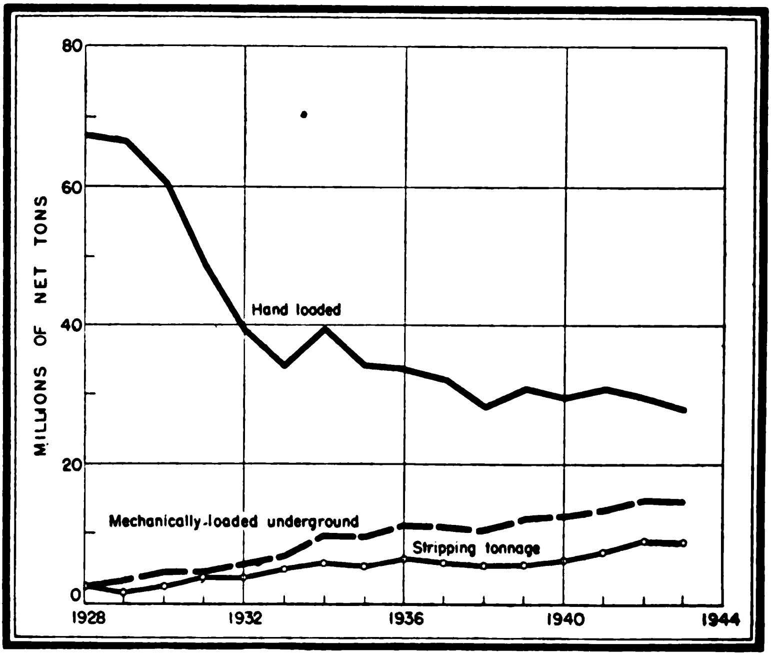

FIGURE 2.—Relative growth of mechanical loading, hand loading, and stripping of Pennsylvania anthracite, 1928–43.

adaptable to current mechanical coal-loading methods than those in the Lehigh and Schuylkill regions. In 1943 the tonnage loaded mechanically in the Northern field was more than four times that in the Western Middle, Eastern Middle, and Southern fields combined. Figure 2 illustrates the relative growth of underground mechanical and hand loading and of stripping, 1928–43.

TABLE 24.—*Relative growth of mechanical loading, hand loading, and stripping in Pennsylvania anthracite mines, 1939–43*

[Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors]

Year	Net tons			Index numbers: 1927=100		
	Mechanical loading underground	Stripping	Hand loading	Mechanical loading underground	Stripping	Hand loading
1939	11, 774, 000	5, 486, 000	30, 798, 000	530	255	43
1940	12, 326, 000	6, 353, 000	29, 191, 000	554	295	41
1941	13, 442, 000	7, 317, 000	30, 435, 000	605	340	43
1942	14, 741, 000	9, 071, 000	30, 495, 000	663	421	43
1943	14, 746, 000	8, 989, 000	27, 990, 000	663	417	39

TABLE 25.—*Pennsylvania anthracite handled by mobile loaders and scrapers and by all types of conveyors in 1943, by fields, in net tons*

Field	Scraper loaders	Pit-car loaders	Hand-loaded face conveyors, all types [1]	Total mechanically loaded underground
Northern	2, 180, 240	133, 689	9, 551, 450	11, 865, 379
Eastern Middle	133, 928		641, 105	775, 033
Western Middle	366, 094	25, 550	1, 443, 819	1, 835, 463
Southern	127, 027	25, 550	117, 341	269, 918
	2, 807, 289	184, 789	11, 753, 715	14, 745, 793

[1] Shaker chutes, etc., including those equipped with duckbills.

TABLE 26.—*Pennsylvania anthracite loaded mechanically underground, 1939–43*

Year	Scrapers		Conveyors and pit-car loaders [1]		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons handled	Number of units	Net tons handled
1939	535	3, 088, 956	1, 997	8, 684, 877	2, 532	11, 773, 833
1940	[2] 547	[2] 2, 983, 792	2, 189	9, 342, 208	2, 736	12, 326, 000
1941	[2] 505	[2] 2, 673, 983	2, 432	10, 768, 004	2, 937	13, 441, 987
1942	[2] 524	[2] 2, 871, 926	2, 491	11, 869, 533	3, 015	14, 741, 459
1943	[2] 515	[2] 2, 807, 289	2, 701	11, 938, 504	3, 216	14, 745, 793

[1] Includes duckbills and other self-loading conveyors, which handle only a small part of the total.
[2] Includes mobile loaders

Strip-pit operations.—Strip-pit operations to recover anthracite are conducted extensively throughout the region. The mountains surrounding the anthracite fields are steep and rugged, and in the Lehigh and Schuylkill regions (which are more adaptable to large-scale strip-pit mining than the Wyoming region) the coal pitches sharply from the sides to the valleys below; in the Wyoming region the coal beds are comparatively flat. Strip mining of anthracite was begun in the early 1800's when the overburden was removed by hand or by horse-drawn scrapers. The output by this method of mining in the early years was small, and only the coal that was readily accessible was recovered.

The Federal Geological Survey began to collect statistics on the stripping of anthracite in 1915, when the output by this method of mining was 1,122,000 net tons (1.3 percent of the fresh-mined production). In 1942, according to reports received by the Bureau of Mines from producers, the output from strip pits totaled 9,071,000 tons (16.7 percent of the fresh-mined coal), and in 1943 this method of mining supplied 8,989,387 tons (17.4 percent of the total fresh-mined production).

Although the Wyoming region has been the chief producer of anthracite for more than 60 years, the Lehigh and Schuylkill regions surpass it in tonnage recovered from strip pits. In 1920 when strip-pit coal was 2.5 percent of the industry's fresh-mined output, only 0.6 percent of the Wyoming region's fresh-mined coal came from strip pits, whereas comparable figures for Lehigh and Schuylkill regions were 9.4 and 2.6 percent, respectively. In 1943 when the production from strip pits increased to 17.4 percent of the industry's fresh-mined tonnage, 5 percent of the fresh-mined coal in the Wyoming region came from strip pits, but in the Lehigh and Schuylkill regions strip-pit mining supplied 23.3 and 35.3 percent, respectively, of the fresh-mined total of these regions. The high proportionate tonnage obtained in the Lehigh and Schuylkill regions by stripping operations is due partly to the relative ease of mining thick bed outcrops and partly to the necessity for reducing the over-all costs of production to meet price competition from other fuels. In the Wyoming region beds are thinner and generally flat, thus limiting the quantity of coal uncovered for a given area. Table 27 gives pertinent statistics for certain years during the period 1915–1943. Figure 3 illustrates

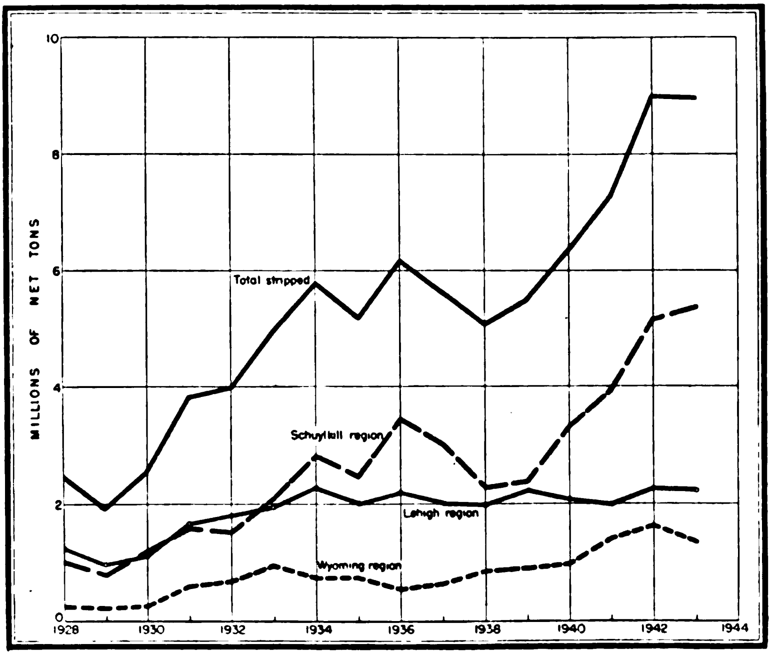

FIGURE 3.—Pennsylvania anthracite mined from strip pits, by regions, 1928–43.

graphically the production of anthracite from strip pits, by regions, 1928–43.

Cutting machines.—The quantity of anthracite cut by machines in 1943 was 1,624,883 net tons compared with 2,285,640 tons in 1942, a 28.9-percent decrease. Details are shown in table 28.

TABLE 27.—*Relative growth of Pennsylvania anthracite mined from strip pits, 1915, 1920, 1925, 1930, and 1940–43*

	Number of power shovels in use [1]	Net tons mined by stripping		Percent of fresh-mined total that was stripped	Number of men employed	Average number of days worked
		Total	Average per shovel			
1915	57	1,121,603	19,677	(2)	(2)	(2)
1920	96	2,054,441	21,400	2.5	(2)	(2)
1925	97	1,578,478	16,273	2.7	(2)	(2)
1930	108	2,536,288	23,484	3.7	(2)	(2)
1940	348	6,352,700	18,255	13.3	4,114	190
1941	(2)	7,316,574	(2)	14.3	4,609	191
1942	(2)	9,070,933	(2)	16.7	4,526	211
1943:						
Lehigh region	(2)	2,232,595	(2)	23.3	1,136	258
Schuylkill region	(2)	5,391,786	(2)	35.3	3,185	216
Wyoming region	(2)	1,352,509	(2)	5.0	740	244
Total, excluding Sullivan County	(2)	8,976,890	(2)	17.4	5,061	230
Sullivan County	(2)	12,497	(2)	16.1	23	85
Grand total, 1943	(2)	8,989,387	(2)	17.4	5,084	229

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[1] Certain equipment reported by stripping contractors may have been counted twice when moved from one small job to another during the year. The amount of such double counting is unknown but presumably is not great.

[2] Data not available.

TABLE 28.—*Pennsylvania anthracite cut by machines, 1942–43, by regions*

Region	1942			1943		
	Cutting machines		Net tons cut by machines	Cutting machines		Net tons cut by machines
	Permissible	All other types		Permissible	All other types	
Lehigh		3	21,907	6		29,400
Schuylkill						
Wyoming	153	85	2,263,733	129	76	1,595,483
Total, excluding Sullivan County	153	88	2,285,640	135	76	1,624,883
Sullivan County						
Grand total	153	88	2,285,640	135	76	1,624,883

Dredge coal.—Dredging anthracite from the stream beds is an important industry to many operators along the banks of the rivers and creeks that drain the anthracite regions. River coal was first dredged in the 1890's, but the earliest production reports received by the Geological Survey were for 1909. From 1909 to 1942, inclusive, dredge operators reported—to the Geological Survey and subsequently to the Bureau of Mines—the recovery of 20,427,129 net tons, and although this is only a small fraction of the total output of anthracite it is important from the standpoint of conservation of natural resources. The industry reached a peak in 1941, when 1,518,000 net tons of anthracite with a value of $1,840,000 were taken from the river and creek beds. In 1943 this source supplied 1,334,737 net tons of anthracite valued at $1,972,777. (See table 29.)

TABLE 29.—*Pennsylvania anthracite produced by dredges in 1943, by rivers*

River (including tributaries)	Net tons	Value	
		Total	Average
Lehigh	37,452	$60,037	$1.60
Schuylkill	342,815	440,055	1.28
Susquehanna	954,470	1,472,685	1.54
	1,334,737	1,972,777	1.48

FOREIGN TRADE [1]

Anthracite exported from the United States in 1943 totaled 4,138,680 net tons compared with 4,438,588 tons in 1942. Virtually all the exported coal was shipped to Canada, where shortages of heating gas and coke created a strong demand for anthracite. Details of imports and exports are shown in tables 30 and 31.

TABLE 30.—*Anthracite imported for consumption in the United States, 1942–43, by countries and customs districts, in net tons*

	1942	1943
Country		
Canada		224
U. S. S. R.	67	
United Kingdom [1]	140,048	165,796
	140,115	166,020
Customs district		
Los Angeles	67	

	1942	1943
Customs district—Con.		
Maine and New Hampshire	62,922	133,874
Massachusetts	61,243	30,317
New York	672	1,829
Rhode Island	15,211	
	140,115	166,020

[1] United Kingdom of Great Britain and Northern Ireland.

TABLE 31.—*Anthracite exported from the United States, 1942–43, by countries, by customs districts and ports of export, in net tons*

Country	1942	1943
North America:		
Bermuda		262
Canada	4,417,689	4,096,896
Iceland	1,988	
Central America:		
British Honduras	2	(1)
Guatemala		6
Nicaragua		1
Mexico	114	363
Newfoundland and Labrador	2,969	1,567
West Indies:		
British	56	88
Cuba	2	22,866
Curaçao (N.W.I.)	11	110
Dominican Republic	22	10
Jamaica	2,570	
Other North America	19	
South America:		
Bolivia	2,836	56
Brazil	10,210	15,957
Surinam	6	
Other South America	88	294
Europe:		
Portugal		10
U. S. S. R		60
United Kingdom [2]		132
Africa	6	2
	4,438,588	4,138,080

Customs district	1942	1943
North Atlantic:		
Connecticut	45	
Maine and New Hampshire	15,743	15,933
Massachusetts	169	8
New York	24,864	21,355
Philadelphia	14,879	39,702
South Atlantic: Maryland	2,621	264
Gulf Coast:		
Florida	64	375
Mobile	2	21
New Orleans	2,853	123
Mexican border:		
Arizona	4	232
El Paso	35	1
Laredo	263	76
Pacific coast:		
Alaska	56	
Oregon		60
San Diego	64	50
Northern border:		
Buffalo	2,410,438	2,130,922
Dakota	867	1,021
Duluth and Superior	4,798	7,740
Michigan	847	13,974
Ohio	14,308	14,689
Rochester	317,909	171,234
St. Lawrence	1,610,750	1,642,168
Vermont	17,009	78,732
	4,438,588	4,138,680

[1] Less than 1 ton.
[2] United Kingdom of Great Britain and Northern Ireland.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Canadian market.—Coal and lignite production in Canada in 1943 decreased 5.7 percent from 1942, whereas coke production increased 8.4 percent. Imports of anthracite in 1943 decreased 7.2 percent from 1942, but imports of bituminous coal increased 17.2 percent. Coal available for consumption in 1943 was 4.3 percent more than in 1942 and coke, 12.5 percent.

See table 32 for coal and coke statistics in Canada.

TABLE 32.—*Coal and coke industry and foreign trade of Canada, 1942–43*

[Thousands of net tons]

	Coal								Coke from coal	
	Anthracite		Bituminous and subbituminous		Lignite		Total			
	1942	1943	1942	1943	1942	1943	[1] 1942	[2] 1943	[1] 1942	[2] 1943
Production			[3]14,350	12,719	[3]4,516	5,068	[3]18,866	17,787	3,275	3,549
Imports	4,802	4,459	20,807	24,394	(4)	(4)	25,609	28,853	720	941
Exports			806	1,101	10	9	816	1.110	45	48
Available for consumption	4,802	4,459	34,351	36,012	4.506	5.059	43,659	45,530	3,950	4,442

[1] Monthly Coal and Coke Statistics for Canada, December 1942.
[2] Monthly Coal and Coke for Canada, December 1943, preliminary.
[3] Revised.
[4] Less than 1,000 tons.

WORLD PRODUCTION

Data on world production of anthracite are incomplete because of unsettled conditions throughout the world. Available data for 1938-1943 are shown in table 33.

TABLE 33.—*World production of anthracite, 1938–43, in metric tons*

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943
Belgium	6,874,520	(1)	(1)	(1)	(1)	(1)
Bulgaria	4,000	6,038	8,000	(1)	(1)	(1)
China	(2)	(1)	(1)	(1)	(1)	(1)
Chosen	1,664,000	2,064,000	(1)	(1)	(1)	(1)
France	(2)	(1)	(1)	(1)	(1)	(1)
Germany	(2)	(1)	(1)	(1)	(1)	(1)
Indochina	2,289,832	2,534,000	2,400,000	(1)	(1)	(1)
Irish Free State	92,157	90,455	74,170	104,871	(1)	(1)
Italy	132,197	100,000	(1)	(1)	(1)	(1)
Japan [3]	(2)	(1)	(1)	(1)	(1)	(1)
Morocco, French	123,200	115,600	[4] 143,000	[4] 139,000	[4] [5] 110,000	(1)
Peru	1,500	3,514	4,500	4,600	(1)	(1)
Portugal	281,740	294,081	286,854	436,324	404,144	368,321
Rumania	3,266	(1)	(1)	(1)	(1)	(1)
Spain	440,253	506,109	1,005,875	1,170,132	1,232,405	1,147,617
Switzerland	3,000	2,500	[5] 7,000	(1)	[5] 40,000	(1)
U. S. S. R.:						
Asiatic	(2)	(1)	(1)	(1)	(1)	(1)
European	(2)	(1)	(1)	(1)	(1)	(1)
United Kingdom	6,378,904	(1)	(1)	(1)	(1)	(1)
United States	41,820,115	46,708,319	46,705,836	51,136,164	54,728,109	55,014,679
World total	108,768,115	(1)	(1)	(1)	(1)	(1)
Total, exclusive of United States	66,948,000	(1)	(1)	(1)	(1)	(1)

[1] Data not available.
[2] Estimate included in total.
[3] Anthracite output of Japan said to average about 225,000 tons a year. Production figures not available.
[4] Production of Djerada Basin only.
[5] Estimate.

COKE AND BYPRODUCTS

By J. A. De Carlo, M. M. Otero, and J. W. Buch

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SUMMARY

In 1943, the second full year of United States participation in World War II, the coke industry contributed coke and coke byproducts—all indispensable for war—in quantities never equaled before. The combined production of byproduct and beehive coke was 71,676,063 tons—63,742,676 tons (89 percent) of byproduct and 7,933,387 tons (11 percent) of beehive—an increase of 1,107,119 tons (2 percent) over the previous peak output in 1942. This increase resulted entirely from the record output of byproduct coke, which increased 1,447,767 tons (2 percent), a gain that more than offset the decline of 340,648 tons (4 percent) in beehive-coke output. The record was the more remarkable as it was accomplished in the face of mine shut-downs and the unavoidable drain of manpower into the armed forces. The effects of mine stoppages, which forced many byproduct-oven operators to slow their coking operations to conserve available supplies of coking coal, are clearly illustrated in figure 1; however, this loss in production was offset in part by the completion of 953 new byproduct ovens during the year, which added 5,220,610 tons to the annual coke-producing capacity of the industry, so that by December the average daily rate of production was 3 percent higher than in January. In the beehive industry many operators were handicapped by the lack of coking coal, in addition to production losses that resulted from mine stoppages, labor shortages, and transportation difficulties, all of which explained the decline in beehive-coke production from 1942.

A survey of employment in the coke industry in 1943 showed 21,632 men employed at byproduct plants and 4,133 at beehive plants; the average output per man per year was 2,947 tons of byproduct and 1,920 tons of beehive coke. In 1918, the year of World War I, the average output per man per year was 1,630 tons for byproduct and 1,854 tons for beehive coke. The increased output of byproduct coke per man per year since 1918 resulted from progress in coke-oven design and mechanical equipment.

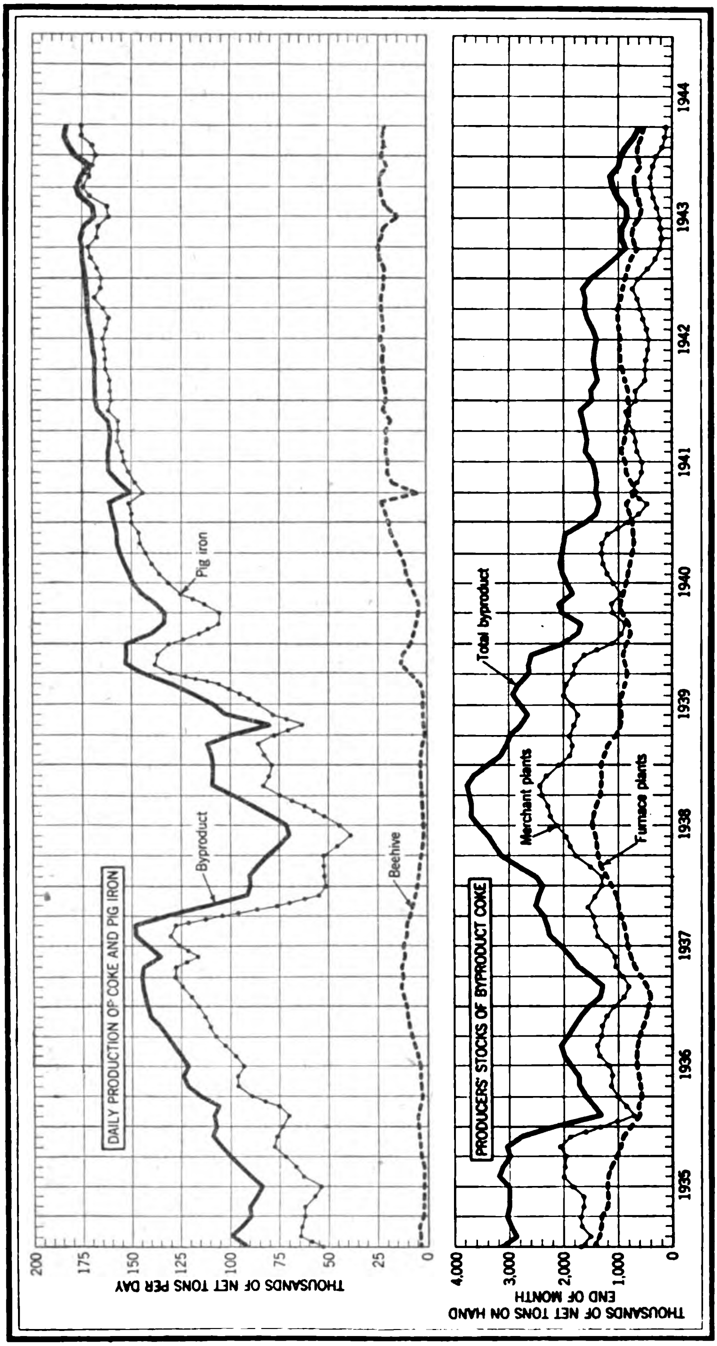

FIGURE 1.—Average daily production of beehive and byproduct coke and pig iron and producers' stocks of byproduct coke, 1935–43, by months.

The average value per ton of coal charged into byproduct and beehive ovens, which has been climbing since 1940, increased 10 percent over the 1942 figure; the average cost of byproduct coal in 1943 increased $0.37, and for beehive ovens the cost rose $0.52 per ton.

The enormous requirements of blast-furnace coke by an expanded iron and steel industry resulted in a movement of nearly 80 percent of byproduct output and 86 percent of beehive to furnaces. According to producers' reports, the quantity of coke used by producers, sold to financially affiliated corporations, or sold to other companies for blast furnace use totaled 57,690,160 tons—50,885,639 tons of byproduct (88 percent) and 6,804,521 tons of beehive (12 percent)—an increase of 4 percent over the quantity so used in 1952. The disposal of coke for other industrial purposes (for foundry use, for the manufacture of producer and water gas, for nonferrous smelting, and for miscellaneous industrial uses) reached a new high in 1943 and totaled 9,606,773 tons compared with 9,190,418 tons so used in 1942. The quantity of coke sold for domestic heating, which has dropped steadily since 1940 because of diversion to the metallurgical industries, decreased 19 percent from the preceding year.

Coke prices increased in general in 1943 because of increases in coal and manufacturing costs. The average realization per ton of furnace coke sold gained $0.73 and was $6.89 in 1943; in the same period, foundry coke advanced $0.10 to $9.85; the unit value of coke sold for the manufacture of water gas increased $0.27 and averaged $7.80; coke sold for other industrial uses climbed $0.23 per ton to $7.11; domestic coke prices followed the sharp upward trends of industrial coke and averaged $8.17 compared with $7.84 in 1942. The price of screenings or breeze increased markedly over 1942 and was $2.95 per ton.

Stocks of coke declined sharply in 1943 and dropped to 862,100 tons on January 1, 1944, the lowest level since January 1, 1926. Furnace-coke stocks at producers' plants decreased 31 percent, and domestic coke stocks declined 56 percent from those at the end of 1942.

Coke exported in 1943 amounted to 994,607 tons—an increase of 18 percent over 1942. Imports of coke totaled 98,127 tons and were 10 percent less than in 1942.

The increased activity in the byproduct industry during 1943, which saw all furnace plants operating toward maximum output of coke, had a marked effect on the production of the four principal byproducts of the coking process. The output of gas and crude light oil increased in 1943 compared with 1942, whereas the production of crude tar and ammonia decreased. The output of coke-oven gas was 15,574,881 M cubic feet higher than in 1942 and totaled 960,454,518 M cubic feet, and crude light oil output gained 4,486,213 gallons to 250,511,095 gallons; but crude tar output dropped 2,008,651 gallons to 738,166,968 gallons, and ammonium sulfate or equivalent declined 9,639,714 pounds to 1,795,386,007 pounds.

The total value of all coke, breeze, and tar produced and of other byproducts sold in 1943 was $686,428,948, a new record, representing an increase of $57,020,526 (9 percent) over 1942.

GOVERNMENT CONTROL MEASURES

In previous Coke and Byproducts chapters, various control measures relating to coke and coke byproducts have been summarized. This review carries the record forward to January 1, 1944.

Byproduct coke.—Maximum prices for byproduct coke from January 1, 1943, to December 6, 1943, were governed by the Office of Price Administration Revised Price Schedule 29 and Maximum Price Regulation 121, with subsequent amendments. To bring these together in one form the Office of Price Administration issued Maximum Price Regulation 29 on December 6, 1943, effective the same day. This regulation covered ceiling prices on all byproduct and retort-gas coke produced in the United States. Amendment 1 to Maximum Price Regulation 29, issued December 20, 1943, effective the same day, increased the maximum prices of byproduct coke produced in the South and Midwest by $0.30 per ton.

In order that byproduct and beehive coke could be placed under allocation if it became necessary, the War Production Board issued General Preference Order M–292 on March 12, 1943. This regulation made it mandatory for all byproduct- and beehive-coke producers to file monthly report forms with the Bureau of Mines—Form BY for byproduct and Form BE for beehive.

Authority covering the distribution of domestic coke was delegated to the Solid Fuels Administration for War by the War Production Board, through issuance of Directive 33 on December 31, 1943.

Beehive coke.—At the beginning of the year beehive-coke prices were governed by Revised Price Schedule 77 and Maximum Price Schedule 121, together with the several amendments. On December 13, 1943, effective the same day, the Office of Price Administration issued Maximum Price Regulation 77, which was designed to bring together in one form the provisions of Revised Price Schedule 77 and of Maximum Price Regulation 121 relating to beehive-oven coke; this regulation covered all beehive-oven coke. Amendment 1 to Maximum Price Regulation 77, issued December 20, 1943, effective November 29, 1943, raised the price of beehive-furnace coke produced in the Connellsville district in hand-drawn ovens from trucked coal by $0.75 per ton to $7.75 and by $0.50 per ton to $7 for beehive-furnace coke produced in machine-drawn ovens. Amendment 2 to Maximum Price Regulation 77, issued January 4, 1944, effective November 23, 1943, raised the price of beehive coke, other than furnace coke made in the Connellsville district in hand-drawn ovens, by an amount not to exceed $1.25 per ton and $1 per ton for coke made in machine-drawn ovens. Amendment 3 to Maximum Price Regulation 77 issued January 18, 1944, effective November 29, 1943, increased the price of beehive-oven coke made in Wise County, Va., by $1 per ton.

Benzol.—Since May 1942 the Government has prohibited the use of benzol in motor fuel through issuance of General Preference Order M–137 on April 20, 1942; an amendment thereto, effective July 1, 1942, placed it under complete allocation. On July 23, 1943, this order was amended to read Allocation Order M–137 and was in force at the end of the year.

Maximum prices on benzol, toluol, xylol, and other light-oil derivatives were under the terms of the General Maximum Price Regulation, which fixed maximum prices at the individual varying highs as of March 1942, except for any of the above products going into the manufacture of aviation gasoline and synthetic rubber.

Toluol.—Throughout 1943 toluol remained under complete priority control through provisions of General Preference Order M–34, effective August 1941, and amendments thereto, effective December 30, 1941, and February 1, 1942. The order title was amended to read Allocation Order M–34 on July 23, 1943, and included all provisions set forth in previous orders.

Xylol.—Xylol and xylol-range aromatic materials derived from coal tar have been under allocation since July 1, 1942, through issuance of Amendment 1 to General Preference Order M–150; and Amendment 2 to General Preference Order M–150, issued August 29, 1942, effective the same day, further defined deliveries by kinds and for specific uses.

Naphthalene.—In 1943 naphthalene was under allocation, under terms of Conservation Order M–105 issued May 6, 1942, effective the same day.

Pyridine.—Production and distribution of pyridine in 1943 were governed by the provisions of Conservation Order M–185, effective September 1, 1942; the title was amended to read Allocation Order M–185 on July 29, 1943.

Tar.—On March 30, 1943, the War Production Board issued General Preference Order M–297, effective May 1, 1943, which provided for the allocation of crude coal tar and placed restrictions on the burning of tar and use of tar-acid oil. Ceiling prices for crude coal tar at each of the active byproduct-coke plants were established on August 20, 1943, by the Office of Price Administration in Maximum Price Regulation 447.

Ammonium sulfate and ammonia liquor.—Ammonium sulfate and ammonia liquor produced at byproduct-coke plants were under allocation throughout the year under provisions of General Preference Order M–163, issued May 30, 1942, effective June 1, 1942; maximum prices of ammonium sulfate were controlled by the terms of Maximum Price Regulation 205, issued August 17, 1942, effective August 22, 1942, and Amendment 1, issued March 15, 1943, effective March 20, 1943.

TECHNOLOGIC DEVELOPMENTS

Progress in technologic developments in 1943 was stimulated by war and directed toward solutions of wartime problems. The Bureau of Mines conducted several important studies on coal preparation, and the conclusions reached made possible the use of coals for metallurgical purposes that otherwise were not suitable because of high sulfur, ash, and phosphorus content.[1] A wider selection of coals for carbonization was made possible through technologic investigation of the chemical composition and carbonizing properties of various coals.[2] Blast-furnace requirements were studied in detail by Lowry and Mayers,[3] who emphasized the importance of coke structure and analysis. Expanded aluminum production and the scarcity of petroleum coke in 1943 aroused concern over the available supply of coke suitable for making carbon electrodes. The Bureau of Mines developed a method of producing carbon electrodes from coke made from certain low-ash coals.[4] A survey of the accomplishments of the Bureau of Mines in research work on coal during the fiscal year 1943 has been made available in the form of an annual report.[5]

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[1] DeKay, Henry E., Turnbull, Louis A., Scudder, James, and Toenges, Albert L., Control of Sulfur and Ash in Mine-Run Metallurgical Coal: Bureau of Mines Rept. of Investigations 3742, 1943, 28 pp.

Geer, M. R., Davis, F. T., and Yancey, H. F., Occurrence of Phosphorus in Washington Coal and Its Removal: Am. Inst. Min. and Met. Eng. Tech. Pub. 1586, 1943, 8 pp.

[2] Davis, J. D., Reynolds, D. A., Sprunk, G. C., and Holmes, C. R., Carbonizing Properties and Petrographic Composition of Taggart-Bed Coal from Mines 30 and 31, Lynch, Harlan County, Ky., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals: Bureau of Mines Tech. Paper 650, 1943, 45 pp.

Davis, J. D., and Reynolds, D. A., Carbonizing Properties of McAlester-Bed Coal from Dow No. 10 Mine, Dow, Pittsburg County, Okla.: Oklahoma Geol. Survey Min. Rept. 15, 1942, 13 pp.

[3] Lowry, H. H., and Mayers, M. A., Properties of Blast-Furnace Coke: Iron and Steel Eng., vol. 20, No. 2, February 1943, pp. 36–46.

POST-WAR OUTLOOK

The carbonization of coal in byproduct ovens faces an encouraging outlook in our national economy after hostilities cease. The contribution of metallurgical fuel by the beehive industry in our war program has been noteworthy; however, the economy of byproduct ovens will doubtless entirely displace the beehive ovens as a source of metallurgical fuel in future, except for emergencies. Although the future outlook for the byproduct industry is favorable, the present high production rate will not be maintained because old ovens will fail and the demands for steel will diminish. It is generally agreed that civilian requirements of steel products will not equal the present wartime demands, and this will doubtless lower the requirements of furnace coke. However, the displacement of beehive coke, the reestablishment of domestic coke markets to pre-war levels, and the increasing demands for light oil and coal-tar products point toward active markets for the byproduct industry. The potential scope of application of the light-oil and coal-tar chemicals is virtually limitless, and present-day uses will increase. The rapidly expanding plastic, synthetic rubber, aviation gasoline, pharmaceutical, and dyestuffs industries are some of the more important outlets for increasing quantities of benzol, cresols, cresylic acid, phenol, pyridine, and other products derived mainly from byproduct coking.

TABLE 1.—*Salient statistics of the coke industry in the United States in 1943*

	Byproduct	Beehive	Total
Coke produced—			
At merchant plants:			
Quantity....net tons..	14, 750, 033	(1)	14, 750, 033
Value....	$114, 280, 452		$114, 280, 452
At furnace plants:			
Quantity....net tons..	48, 992, 643		48, 992, 643
Value....	$309, 844, 677		$309, 844, 677
Total:			
Quantity....net tons..	63, 742, 676	7, 933, 387	71, 676, 063
Value....	$424, 125, 129	$51, 992, 343	$476, 117, 472
Screenings or breeze produced:			
Quantity....net tons..	4, 789, 569	151, 343	4, 940. 912
Value....	$12, 206, 564	$177, 632	$12, 384, 196
Coal charged into ovens:			
Quantity....net tons..	90, 018, 941	12, 441, 064	102, 460, 005
Value....	$427, 541, 891	$37, 843, 446	$465, 385, 337
Average per ton....	$4. 75	$3. 04	$4. 54
Average yield in percent of coal charged:			
Coke....	70. 81	63. 77	69. 95
Breeze (at plants actually recovering)....	5. 40	3. 00	5. 27
Ovens:			
In existence January 1....	13, 303	16, 295	29, 598
In existence December 31....	14, 253	17, 666	31, 919
Dismantled during year....	3	673	676
In course of construction December 31....	528	--------	528
Annual capacity of ovens December 31....net tons..	71, 378, 408	11, 230, 396	82, 608, 804

See footnotes at end of table.

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[4] Selvig, W. A., Ode, W. H., and Gibson, F. H., Coke from Low-Ash Appalachian Coals for Carbon Electrodes in Aluminum Industry: Bureau of Mines Rept. of Investigations 3731, 1943, 22 pp.

[5] Fieldner, A. C., Beltz, J. C., and Fisher, P. L., Annual Report of Research and Technologic Work on Coal, fiscal year 1943: Bureau of Mines Inf. Circ. 7272, 1944, 58 pp.

TABLE 1.—*Salient statistics of the coke industry in the United States in 1943*—Con.

	Byproduct	Beehive	Total
Coke used by producer—			
In blast furnaces:			
Quantity net tons	34,496,795	555,486	35,052,281
Value	$225,275,525	$3,677,616	$228,953,141
In foundries:			
Quantity net tons	57,140		57,140
Value	$394,972		$394,972
To make producer gas:			
Quantity net tons	884,053		884,053
Value	$5,812,963		$5,812,963
To make water gas:			
Quantity net tons	1,771,786		1,771,786
Value	$9,834,079		$9,834,079
For other purposes:			
Quantity net tons	309,297	89,553	398,850
Value	$2,293,390	$743,785	$3,037,175
Disposal of coke:			
Sold to financially affiliated corporations—			
For blast-furnace use:			
Quantity net tons	12,256,558	1,538,192	13,794,750
Value	$69,421,276	$9,426,483	$78,847,759
For foundry use:			
Quantity net tons	5,661		5,661
Value	$31,762		$31,762
For manufacture of water gas:			
Quantity net tons	502,409		502,409
Value	$3,212,936		$3,212,936
For other purposes:			
Quantity net tons	274,810		274,810
Value	$1,830,230		$1,830,230
Sold to other consumers—			
For blast-furnace use:			
Quantity net tons	4,132,286	4,710,843	8,843,129
Value	$29,995,485	$30,889,798	$60,885,283
For foundry use:			
Quantity net tons	2,217,499	326,589	2,544,088
Value	$22,557,740	$2,505,231	$25,062,971
For manufacture of water gas:			
Quantity net tons	751,982	146,682	898,664
Value	$6,028,560	$977,673	$7,006,233
For other industrial use:			
Quantity net tons	1,805,935	463,377	2,269,312
Value	$12,984,481	$3,147,955	$16,132,436
For domestic use:			
Quantity net tons	4,784,090	101,438	4,885,528
Value	$39,292,885	$621,842	$39,914,727
Disposal of screenings or breeze:			
Used by producer—			
For raising steam:			
Quantity net tons	3,068,273	28,008	3,096,281
Value	$7,465,961	$35,904	$7,501,865
To make producer or water gas:			
Quantity net tons	40,945		40,945
Value	$153,855		$153,855
For other purposes:			
Quantity net tons	576,566	6,138	582,704
Value	$1,457,429	$10,600	$1,468,029
Sold:			
Quantity net tons	1,291,909	61,192	1,353,101
Value	$3,920,076	$67,518	$3,987,594
Average receipts per ton sold:			
Furnace coke (merchant sales)	$7.26	$6.56	$6.89
Foundry coke	$10.17	$7.67	$9.85
For manufacture of water gas	$8.02	$6.63	$7.80
Other industrial coke	$7.19	$6.79	$7.11
Domestic coke	$8.21	$6.13	$8.17
Screenings or breeze	$3.03	$1.10	$2.95
Stocks on hand January 1, 1944:			
Furnace net tons	517,452	30,740	548,192
Foundry do	21,490	482	21,972
Domestic and other do	286,671	5,265	291,936
Screenings or breeze do	1,278,220	4,868	1,283,088
Exports do			994,607
Imports do			98,127
Calculated consumption do			71,406,532
Byproducts produced:			
Gas M cubic feet	960,454,518		960,454,518
Wasted percent	1.81		1.81
Burned in coking process do	36.52		36.52
Surplus sold or used do	61.67		61.67
Tar gallons	738,166,968		738,166,968
Ammonium sulfate or equivalent pounds	1,795,386,007		1,795,386,007
Crude light oil gallons	250,511,095		250,511,095

See footnotes at end of table.

TABLE 1.—*Salient statistics of the coke industry in the United States in 1943*—Con.

	Byproduct	Beehive	Total
Yield of byproducts per ton of coal:			
Gas .... M cubic feet	10.68	....	10.68
Tar .... gallons	8.11	....	8.11
Ammonium sulfate or equivalent .... pounds	20.32	....	20.32
Crude light oil .... gallons	2.83	....	2.83
Value of byproducts sold:			
Gas (surplus)	$88,620,185	....	$88,620,185
Tar:			
Sold	$24,569,762	....	$24,569,762
Used by producer	$15,997,575	....	$15,997,575
Ammonium sulfate or equivalent	$22,619,116	....	$22,619,116
Crude light oil and derivatives	$32,686,154	....	$32,686,154
Other byproducts [2]	$13,434,488	....	$13,434,488
Total value of coke and breeze produced and byproducts sold [3]	$634,258,973	$52,169,975	$686,428,948

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[1] Not separated as merchant and furnace plants.
[2] Includes naphthalene, tar derivatives, and miscellaneous byproducts.
[3] Includes value of tar used by producer.

TABLE 2.—*Statistical trends of the coke industry in the United States, 1923 and 1940–43*

	1923	1940	1941	1942	1943
Coke produced:					
Byproduct .... net tons	37,597,664	54,014,309	58,482,422	62,294,909	63,742,676
Beehive .... do	19,379,870	3,057,825	6,704,156	8,274,035	7,933,387
Total .... do	56,977,534	57,072,134	65,186,578	70,568,944	71,676,063
Percent of total from byproduct ovens	66.0	94.6	89.7	88.3	88.9
Producers' stocks of coke, end of year .... net tons	[1] 1,221,737	1,956,442	1,758,086	1,489,049	862,100
Exports, all coke .... do	1,237,342	804,095	708,971	839,582	994,607
Imports, all coke [2] .... do	85,002	112,550	267,886	108,782	98,127
Consumption, calculated, all coke .... do	55,173,457	57,026,246	64,943,849	70,107,181	71,406,532
Disposal of coke, all coke sold or used:					
Furnace coke .... net tons	47,774,408	42,483,624	50,454,325	55,491,570	57,690,160
Foundry coke .... do	3,600,719	2,089,962	2,846,459	2,591,576	2,606,889
Other industrial (including producer and water gas) .... net tons	[2] 2,283,888	3,581,676	4,224,597	5,452,457	6,326,224
Domestic coke .... do	2,733,414	8,231,013	6,682,959	6,061,694	4,885,528
For all other purposes .... do	(3)	1,458,435	1,165,526	1,146,385	673,660
Ovens:					
Byproduct, in existence, end of year	11,156	12,734	13,016	13,303	14,253
Beehive, in existence, end of year	62,349	15,150	18,669	16,295	17,666
Byproduct, under construction, end of year	629	492	181	1,327	528
Cost of coal charged, byproduct ovens, average per ton	$4.76	$3.68	$3.92	$4.38	$4.75
Prices of coke:					
Average spot price of Connellsville furnace coke, f. o. b. ovens	$5.33	$4.42	$5.92	$6.01	$6.46
Average realization on byproduct coke sold:					
Furnace coke (merchant sales)	$6.74	$4.55	$5.70	$6.58	$7.26
Foundry coke	$10.54	$8.67	$9.76	$10.15	$10.17
Other industrial (including water gas)	$9.06	$5.86	$6.68	$7.30	$7.43
Domestic	$9.05	$6.03	$6.96	$7.88	$8.21
Yield of byproducts per ton of coal charged:					
Tar .... gallons	8.1	8.79	8.52	8.41	8.11
Ammonium sulfate or equivalent .... pounds	21.2	22.00	21.34	20.85	20.32
Light oil .... gallons	2.7	2.93	2.90	2.88	2.83
Surplus gas sold or used .... M cubic feet	5.9	6.84	6.71	6.65	6.59
Average gross receipts for byproducts, per ton of coke produced:					
Tar sold and used	$0.51	$0.571	$0.566	$0.642	$0.636
Ammonia and its compounds	$0.84	$0.364	$0.371	$0.348	$0.355
Light oil and its derivatives (including naphthalene)	$0.51	$0.421	$0.431	$0.501	$0.546
Surplus gas sold or used	$1.37	$1.507	$1.454	$1.426	$1.390
Total byproducts, including breeze	$3.48	$3.117	$3.130	$3.015	$3.297

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[1] Furnace and foundry coke only.
[2] Before 1934, figures represent general imports; beginning with 1934, they represent imports for consumption only.
[3] "For all other purposes" included under "Other industrial (including producer and water gas)."

SCOPE OF REPORT

This report contains final statistics for the byproduct- and beehive-coke industry for 1943. In accordance with usual procedure, most of the tables herein also include comparable data for 3 or 4 preceding years. In addition to the customary annual report on byproduct and beehive coke, tables are included showing the quantity and value of coke recovered from beehive breeze dumps and salient statistics of the coal-gas industry, compiled from reports by the operators to the Bureau of Mines

In addition to the coke produced in byproduct ovens, beehive ovens, and coal-gas retorts, coke is obtained in the refining of petroleum and of tar. Although tonnages of petroleum coke and coal-tar-pitch coke are very small in comparison with byproduct- and beehive-coke production, they are important in the production of carbon and graphite electrodes for the aluminum and magnesium industries. In 1943, 1,388,000 tons of petroleum coke and 111,000 tons of coal-tar-pitch coke were produced compared with 1,338,000 and 118,000 tons, respectively, in 1942.

Since, in general, only coke from byproduct and beehive ovens is adapted to blast-furnace and foundry use and since most of the coke produced is directed to these uses, the coke trade is concerned more especially with byproduct and beehive coke, and the statistics of this report are confined to these two types.

The standard unit of measurement in the coke industry is the short ton of 2,000 pounds; that unit is employed throughout this report unless otherwise specified.

COKE AND COKE BREEZE

MONTHLY AND WEEKLY PRODUCTION

Tables 3 to 7 summarize the statistics of weekly and monthly production of byproduct and beehive coke Weekly and monthly data on byproduct coke are based upon reports from producers. The monthly rate of production of byproduct coke showed a gradual upward trend in 1943 (mainly because of new oven installations placed in operation) and reached a peak of 5,555,600 tons in December. Data on weekly production indicated fluctuations in production rates and in 1943 ranged from a low point for the week ended November 6 to a peak in the week ended December 18.

Weekly production of beehive coke was estimated from records of car loadings received each week from the principal coke-carrying railroads with minor adjustments. Monthly production of beehive coke was based upon reports from producers. The monthly output of beehive coke in 1943 fluctuated from the 753,200 tons in March to 420,400 tons in June, the lowest figure since April 1941. Table 6 shows the production of beehive coke by weeks and exhibits the effects of mine stoppages in 1943, and weekly output ranged from 53,200 tons for the week ended June 26 to 177,400 tons for the week ended April 10.

TABLE 3.—*Byproduct, beehive, and total coke produced in the United States, 1940–43, by months and average per day, in net tons* [1]

Month	1940		1941		1942		1943	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Byproduct:								
January	4,720,600	152,300	4,938,800	159,300	5,228,900	168,700	5,400,600	174,200
February	4,028,300	138,900	4,507,400	161,000	4,720,300	168,600	4,907,500	175,300
March	4,136,600	133,400	5,005,200	161,500	5,230,700	168,700	5,431,800	175,200
April	3,995,800	133,200	4,479,600	149,300	5,060,400	168,700	5,280,800	176,000
May	4,256,000	137,300	4,851,600	156,500	5,265,600	169,900	5,406,600	174,400
June	4,387,200	146,200	4,841,700	161,400	5,104,600	170,200	5,066,900	168,900
July	4,632,400	149,400	5,019,600	161,900	5,282,800	170,400	5,273,100	170,100
August	4,695,500	151,500	5,018,900	161,900	5,320,000	171,600	5,473,600	176,600
September	4,640,700	154,700	4,811,400	160,400	5,168,400	172,300	5,347,900	178,300
October	4,853,600	156,600	4,976,500	160,500	5,343,800	172,400	5,445,500	175,700
November	4,763,500	158,800	4,839,200	161,300	5,196,000	173,200	5,152,800	171,800
December	4,904,100	158,200	5,192,500	167,500	5,373,400	173,300	5,555,600	179,200
	54,014,300	147,600	58,482,400	160,200	62,294,900	170,700	63,742,700	174,600
Beehive:								
January	252,300	9,300	542,500	17,500	675,400	21,800	662,700	21,400
February	164,400	6,600	523,900	18,700	635,500	22,700	644,100	23,000
March	143,100	5,500	618,100	19,900	694,400	22,400	753,200	24,300
April	108,400	4,200	98,200	3,300	686,600	22,900	686,500	22,900
May	112,300	4,200	571,200	18,400	700,200	22,600	657,500	21,200
June	159,800	6,400	595,400	19,800	719,000	24,000	420,400	14,000
July	244,400	9,400	610,400	19,700	692,800	22,300	633,900	20,400
August	294,200	10,900	644,500	20,800	696,700	22,500	715,600	23,100
September	287,800	11,500	605,800	20,200	697,600	23,300	711,600	23,700
October	384,200	14,200	646,800	20,900	722,100	23,300	730,400	23,600
November	416,800	16,000	561,300	18,700	667,400	22,200	607,000	20,200
December	490,100	19,600	686,100	22,100	686,300	22,100	710,500	22,900
	3,057,800	9,800	6,704,200	18,400	8,274,000	22,700	7,933,400	21,700
Total coke:								
January	4,972,900	161,600	5,481,300	176,800	5,904,300	190,500	6,063,300	195,600
February	4,192,700	145,500	5,031,300	179,700	5,355,800	191,300	5,551,600	198,300
March	4,279,700	138,900	5,623,300	181,400	5,925,100	191,100	6,185,000	199,500
April	4,104,200	137,400	4,577,800	152,600	5,747,000	191,600	5,967,300	198,900
May	4,368,300	141,500	5,422,800	174,900	5,965,800	192,500	6,064,100	195,600
June	4,547,000	152,600	5,437,100	181,200	5,823,600	194,200	5,487,300	182,900
July	4,876,800	158,800	5,630,000	181,600	5,975,600	192,700	5,907,000	190,500
August	4,989,700	162,400	5,663,400	182,700	6,016,700	194,100	6,189,200	199,700
September	4,928,500	166,200	5,417,200	180,600	5,866,000	195,600	6,059,500	202,000
October	5,237,800	170,800	5,623,300	181,400	6,065,900	195,700	6,175,900	199,300
November	5,180,300	174,800	5,400,500	180,000	5,863,400	195,400	5,759,800	192,000
December	5,394,200	177,800	5,878,600	189,600	6,059,700	195,400	6,266,100	202,100
	57,072,100	157,400	65,186,600	178,600	70,568,900	193,400	71,676,100	196,300

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[1] Daily average production of beehive coke before 1941 was calculated by subtracting Sundays and holidays in each month: 1941–43 daily average has been calculated by dividing the total monthly production by the total number of days in the month.

TABLE 4.—*Byproduct coke produced in the United States in 1943, by weeks*

[Based upon reports from all producers]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 2	[1] 342,400	May 8	1,212,300	Sept. 11	1,245,000
9	1,210,900	15	1,231,700	18	1,250,000
16	1,219,700	22	1,230,600	25	1,253,600
23	1,212,100	29	1,219,300	Oct. 2	1,254,700
30	1,224,700	June 5	1,203,700	9	1,252,300
Feb. 6	1,212,900	12	1,199,900	16	1,249,500
13	1,224,500	19	1,219,100	23	1,208,500
20	1,224,600	26	1,160,000	30	1,198,400
27	1,226,700	July 3	1,144,700	Nov. 6	1,126,100
Mar 6	1,223,600	10	1,181,600	13	1,176,100
13	1,230,400	17	1,158,600	20	1,237,800
20	1,218,300	24	1,218,400	27	1,253,400
27	1,221,200	31	1,221,900	Dec. 4	1,266,300
Apr. 3	1,235,200	Aug. 7	1,238,400	11	1,270,700
10	1,235,800	14	1,233,500	18	1,280,000
17	1,234,700	21	1,240,900	25	1,251,500
24	1,226,700	28	1,245,600	26–31	[2] 1,023,700
May 1	1,215,100	Sept. 4	1,245,400		
					[2] 63,742,700

[1] 2 days only.

[2] 6 days only.

TABLE 5.—*Byproduct coke produced in the United States in 1943, by months and States, in net tons*

[Based upon reports from all producers]

State	January	February	March	April	May	June	July
Alabama	477, 500	447, 600	464, 100	457, 100	469, 600	413, 300	439, 400
California	12, 500	18, 700	14, 800	26, 300	32, 200	31, 600	30, 700
Colorado	55, 600	50, 400	58, 400	56, 000	57, 600	54, 500	57, 200
Illinois	297, 600	262, 500	290, 400	297, 300	312, 200	292, 000	299, 700
Indiana	669, 000	613, 300	688, 600	648, 200	658, 400	637, 600	665, 900
Maryland	182, 700	164, 200	182, 000	171, 100	172, 300	167, 800	174, 600
Massachusetts	97, 800	89, 500	100, 700	96, 100	100, 500	97, 000	98, 000
Michigan	261, 600	237, 400	257, 900	246, 300	248, 200	220, 000	232, 500
Minnesota	84, 900	77, 400	82, 800	78, 600	79, 400	76, 700	80, 300
New Jersey	87, 500	78, 400	88, 300	85, 000	85, 700	82, 900	86, 200
New York	421, 700	385, 300	424, 500	424, 000	430, 100	434, 200	466, 000
Ohio	853, 300	765, 900	876, 100	863, 600	883, 700	846, 200	870, 200
Pennsylvania	1, 440, 200	1, 297, 700	1, 443, 100	1, 385, 400	1, 416, 800	1,266, 700	1, 318, 100
Tennessee	22, 300	19, 400	21, 300	21, 100	22, 000	21, 300	21, 700
Utah	20, 200	18, 200	20, 200	19, 500	19, 100	18, 000	20, 100
Washington					100	1, 400	1, 000
West Virginia	223, 100	204, 500	224, 800	218, 400	224, 600	216, 200	219, 900
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	193, 100	177, 100	193, 800	186, 800	194, 100	189, 500	191, 600
	5, 400, 600	4, 907, 500	5, 431, 800	5, 280, 800	5, 406, 600	5, 066, 900	5, 273, 100
At merchant plants	1, 243, 100	1, 132, 700	1, 252, 400	1, 212, 000	1, 249, 600	1, 200, 100	1, 242, 000
At furnace plants	4, 157, 500	3, 774, 800	4, 179, 400	4, 068, 800	4, 157, 000	3, 866, 800	4, 031, 100

State	August	September	October	November	December	Total
Alabama	476, 700	453, 400	381, 700	353, 800	482, 300	5, 316, 500
California	31, 500	29, 100	29, 800	28, 700	31, 900	317, 800
Colorado	56, 800	56, 400	57, 500	55, 300	56, 800	672, 500
Illinois	310, 400	311, 000	321, 700	310, 000	320, 700	3, 625, 500
Indiana	672, 200	672, 300	710, 100	695, 500	780, 800	8, 111, 900
Maryland	173, 800	168, 700	172, 100	155, 200	175, 300	2, 059, 800
Massachusetts	99, 000	97, 600	100, 200	97, 400	100, 300	1, 174, 100
Michigan	252, 600	250, 800	255, 000	236, 600	249, 500	2, 948, 400
Minnesota	78, 400	76, 400	81, 200	78, 500	81, 800	956, 400
New Jersey	86, 300	83, 500	85, 500	81, 400	83, 600	1, 014, 300
New York	477, 700	464, 900	474, 300	457, 700	487, 000	5, 347, 400
Ohio	881, 700	850, 700	898, 000	865, 300	816, 100	10, 270, 800
Pennsylvania	1, 422, 900	1, 391, 400	1, 421, 400	1, 294, 900	1, 420, 300	16, 518, 900
Tennessee	21, 500	20, 800	21, 100	20, 200	21, 500	254, 200
Utah	20, 000	19, 500	19, 900	17, 600	28, 400	240. 700
Washington	1, 400	2, 000	3, 300	2, 600	3, 100	14, 900
West Virginia	218, 000	211, 800	219, 500	212, 900	218, 100	2, 611, 800
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	192, 700	187, 600	193, 200	189, 200	198, 100	2, 286, 800
	5, 473, 600	5, 347, 900	5, 445, 500	5, 152, 800	5, 555, 600	63, 742, 700
At merchant plants	1, 257, 000	1, 228, 900	1, 254, 400	1, 205, 800	1, 272, 000	14, 750. 000
At furnace plants	4, 216, 600	4, 119, 000	4, 191, 100	3, 947, 000	4, 283, 600	48, 992, 700

TABLE 6.—*Beehive coke produced in the United States in 1943, by weeks*

[Estimated from railroad shipments]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 2	[1] 34, 800	May 8	133, 100	Sept. 11	161, 400
9	149, 400	15	160, 700	18	163, 100
16	152, 000	22	157, 400	25	169, 400
23	153, 100	29	165, 100	Oct. 2	162, 800
30	153, 800	June 5	59, 400	9	173, 100
Feb. 6	157, 900	12	134, 700	16	170, 600
13	157, 200	19	158, 500	23	165, 800
20	149, 200	26	53, 200	30	171, 400
27	166, 200	July 3	96, 700	Nov. 6	71, 400
Mar. 6	161, 000	10	127, 400	13	144, 300
13	163, 800	17	136, 600	20	167, 800
20	163, 400	24	160, 200	27	169, 800
27	169, 300	31	166, 200	Dec. 4	172, 000
Apr. 3	154, 000	Aug. 7	162, 100	11	165, 600
10	177, 400	14	163, 200	18	168, 600
17	159, 900	21	166, 100	25	154, 400
24	165, 400	28	162, 000	[1]26–3	[2] 125, 100
May 1	146, 400	Sept. 4	160, 000		
					7, 933, 400

[1] 2 days only.

[2] 6 days only.

TABLE 7.—*Beehive coke produced in the United States in 1943, by months and States, in net tons*

[Based on reports from producers]

State	January	February	March	April	May	June	July
Alabama	4,100	4,000	4,700	3,900	3,900	2,400	3,000
Colorado	7,100	7,000	7,700	7,600	7,000	5,300	7,700
Kentucky	----------	----------	----------	----------	----------	----------	----------
Pennsylvania	579,000	562,600	658,000	607,600	583,200	367,100	549,200
Tennessee	5,400	6,100	7,300	5,600	2,700	2,100	1,900
Utah	3,800	2,900	1,400	1,100	1,200	1,000	13,000
Virginia	27,700	25,700	30,700	25,600	25,400	16,400	23,500
West Virginia	35,600	35,800	43,400	35,100	34,100	26,100	35,600
	662,700	644,100	753,200	686,500	657,500	420,400	633,900

State	August	September	October	November	December	Total
Alabama	4,400	4,300	----------	----------	----------	34,700
Colorado	7,000	7,100	7,800	6,400	7,400	85,100
Kentucky	2,500	4,700	8,100	6,600	7,400	29,300
Pennsylvania	630,700	621,700	635,000	523,400	616,900	6,934,400
Tennessee	2,900	3,200	4,100	3,900	3,700	48,900
Utah	9,300	11,000	14,100	12,400	12,900	84,100
Virginia	24,400	25,100	23,500	21,200	24,100	293,300
West Virginia	34,400	34,500	37,800	33,100	38,100	423,600
	715,600	711,600	730,400	607,000	710,500	7,933,400

PRODUCTION BY FURNACE AND NONFURNACE PLANTS

The classification of "furnace" and "nonfurnace" or "other" plants as used in this report applies to the byproduct industry only. Furnace plants are those affiliated with the iron and steel industry, with an output that does not ordinarily enter the open market. "Nonfurnace" or "other" plants include a few plants affiliated with local iron furnaces but producing more coke than their furnaces can absorb and therefore depending chiefly on the foundry and domestic trade or on merchant sales of furnace coke for disposal of their output. This latter classification also includes plants affiliated with alkali works; low-temperature carbonization plants; and in addition a number of plants that, although not public utilities, were constructed primarily to supply city gas, which sell their coke for domestic, industrial, or metallurgical uses.

Four plants were added to the list of furnace plants in 1943—1 plant reclassified from nonfurnace and 3 new plants built to supply coke to new blast-furnace installations—which raised the number of active furnace plants to 50. Furnace plants produced 48,992,643 tons of coke in 1943, or 77 percent of the total output of byproduct coke. In the nonfurnace group, 2 plants were removed from the list of active producers in 1943—1 because operations were discontinued in the middle of 1942 and 1 because of the change in classification; however, 1 new plant that started initial operation in April was added, which resulted in a net loss of 1 plant in this group and reduced the number of active producers to 41. Nonfurnace plants supplied 14,750,033 tons of byproduct coke in 1943, and the rate of production in this group was relatively constant throughout the year.

TABLE 8.—*Number and production of byproduct-coke plants connected with iron furnaces and of other byproduct plants in the United States, 1913, 1918, and 1941–43*

Year	Number of active plants		Coke produced (net tons)		Percent of production	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
1913	20	16	9, 277, 832	3. 436, 868	73. 0	27. 0
1918	36	24	19, 220, 342	6, 777, 238	73. 9	26. 1
1941	45	42	44, 987, 913	13. 494, 509	76. 9	23. 1
1942	46	42	47, 160, 043	15, 134, 866	75. 7	24. 3
1943	50	41	48, 992, 643	14, 750, 033	76. 9	23. 1

TABLE 9.—*Monthly and average daily production of byproduct coke by plants connected with iron furnaces and by all other plants in the United States, 1941–43, in net tons*

Month	1941		1942		1943	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
Monthly production:						
January	3, 825, 200	1, 113, 600	3, 969, 600	1, 259, 300	4, 157, 500	1, 243, 100
February	3, 468, 200	1, 039, 200	3, 578, 300	1, 142, 000	3, 774, 800	1, 132, 700
March	3, 850, 400	1, 154, 800	3, 962, 400	1, 268, 300	4, 179, 400	1, 252, 400
April	3, 423, 700	1, 055, 900	3, 834, 200	1, 226, 200	4, 068, 800	1, 212, 000
May	3, 731, 800	1, 119, 800	3, 985, 300	1, 280, 300	4, 157, 000	1, 249, 600
June	3, 728, 500	1, 113, 200	3, 858, 400	1, 246, 200	3, 866, 800	1, 200, 100
July	3, 875, 600	1, 144, 000	3, 996, 400	1, 286, 400	4, 031, 100	1, 242, 000
August	3, 875, 500	1, 143, 400	4, 030, 700	1, 289, 300	4, 216, 600	1, 257, 000
September	3, 708, 400	1, 103, 000	3, 912, 000	1, 256, 400	4, 119, 000	1, 228, 900
October	3, 827, 900	1, 118, 600	4, 049, 400	1, 294, 400	4, 191, 100	1, 254, 400
November	3, 694, 800	1, 144, 400	3, 917, 400	1, 278, 600	3, 947, 000	1, 205, 800
December	3, 977, 900	1, 214, 600	4, 065, 900	1, 307, 500	4, 283, 600	1, 272, 000
	44, 987, 900	13, 494, 500	47, 160, 000	15, 134, 900	48, 992, 700	14, 750, 000
Average daily production:						
January	123, 400	35, 900	128, 100	40, 600	134, 100	40, 100
February	123, 900	37, 100	127, 800	40, 800	134, 800	40, 500
March	124, 200	37, 300	127, 800	40, 900	134, 800	40, 400
April	114, 100	35, 200	127, 800	40, 900	135, 600	40, 400
May	120, 400	36, 100	128, 600	41, 300	134, 100	40, 300
June	124, 300	37, 100	128, 600	41, 600	128, 900	40, 000
July	125, 000	36, 900	128, 900	41, 500	130, 000	40, 100
August	125, 000	36, 900	130, 000	41, 600	136, 000	40, 600
September	123, 600	36, 800	130, 400	41, 900	137, 300	41, 000
October	123, 500	37, 000	130, 600	41, 800	135, 200	40, 500
November	123, 200	38, 100	130, 600	42, 600	131, 600	40, 200
December	128, 300	39, 200	131, 100	42, 200	138, 200	41, 000
Average	123, 200	37, 000	129, 200	41, 500	134, 200	40, 400

PRODUCTION BY STATES AND DISTRICTS

The surge in coke requirements in 1943 witnessed some interesting changes in the location of coke producers. California became an active producer of byproduct coke for the first time, and Washington produced byproduct coke for the first time since 1937. The record output of byproduct coke in 1943 was obtained from 91 active plants in 22 States; production increased in 13 States and decreased in 9 compared with 1942. The ranking producing States, in order of tonnages, were Pennsylvania, Ohio, Indiana, New York, and Alabama, which together supplied 71 percent of the total output. Of the five ranking States, all except Alabama showed increases over 1942, where the effect of four mine stoppages were not offset by the increased production capacities, and this State yielded fourth place to New York. The States that showed the largest percentages of increase over 1942 were Indiana with 11 percent; Tennessee, 8 percent; Missouri and West Virginia, each 7 percent; and Ohio, with 4 percent.

Production of behive coke increased in three States and decreased in five in 1943 when compared with 1942. Although production of beehive coke in Pennsylvania decreased 5 percent from 1942, it remained the leading producer and supplied 87 percent of the total beehive output. Production in Virginia decreased 57,197 tons and yielded second place to West Virginia, where production increased from 335,221 tons in 1942 to 423,551 in 1943. Utah, with increased new oven capacity, attained a production of 84,093 tons and more than trebled the 1942 output. Production in Kentucky increased from 1,138 tons in 1942 to 29,298 in 1943.

TABLE 10.—*Byproduct and beehive coke produced in the United States, 1918 and 1940–43, by States, in net tons*

[Exclusive of screenings or breeze]

State	1918	1940	1941	1942	1943
Byproduct:					
Alabama	2,634,451	4,727,378	4,759,862	5,579,511	5,316,455
California	----------	----------	----------	----------	317,847
Colorado	230,663	543,548	622,807	676,209	672,502
Connecticut	----------	(1)	(1)	(1)	(1)
Illinois	2,285.610	3,014,840	3,660,878	3,690,155	3,625,457
Indiana	3,898,215	6,412,716	7,406,724	7,337,512	8,111,916
Kentucky	517,749	(1)	(1)	(1)	(1)
Maryland	474,368	1,682,701	1,752,538	2,103,664	2,059,839
Massachusetts	556,397	1,130,311	1,161,732	1,176,359	1,174,152
Michigan	(1)	2,872,026	2,863,563	3,139,137	2,948,389
Minnesota	784,065	524,360	685,873	955,301	956,396
Missouri	(1)	(1)	(1)	(1)	(1)
New Jersey	682,148	1,016,481	1,031,569	1,038,461	1,014,268
New York	1,069,587	5,080,403	5,116,308	5,180,384	5,347,369
Ohio	5,226,334	7,897,929	9,284,194	9,912,783	10,270,758
Pennsylvania	4,586,981	14,861,657	15,632,354	16,310,167	16,518,872
Rhode Island	----------	(1)	(1)	(1)	(1)
Tennessee	124,469	94,454	111,310	234,529	254,211
Utah	----------	218,949	236,607	242,531	240,736
Washington	30,129	----------	----------	----------	14,853
West Virginia	603,393	1,899.849	1,983,619	2,444,368	2,611,825
Wisconsin	(1)	(1)	(1)	(1)	(1)
Combined States	2,293,021	2,036,707	2,172,484	2,273,838	2,286,831
	25,997,580	54,014,309	58,482,422	62,294,909	63,742,676
Beehive:					
Alabama	1,717,721	----------	95,200	95,428	34,674
Colorado	758,784	62,417	80,196	87,447	85,141
Georgia	22,048	----------	----------	----------	----------
Kentucky	301,036	(1)	2,054	1,138	29,298
New Mexico	597,072	----------	----------	----------	----------
Ohio	138,909	----------	----------	----------	----------
Oklahoma	(1)	----------	----------	----------	----------
Pennsylvania	22,136,664	2,550,367	5,891,118	7,309,337	6,934,445
Tennessee	302,637	5,251	39,083	72,541	48,861
Utah	(1)	7,398	10,244	22,402	84,093
Virginia	1,234,256	198,379	324,573	350,521	293,324
Washington	93,659	(1)	----------	----------	----------
West Virginia	2,716,613	233,154	261,688	335,221	423,551
Combined States	461,393	859	----------	----------	----------
	30.480,792	3,057,825	6,704,156	8,274,035	7,933,387
Grand total	56,478,372	57,072,134	65,186,578	70,568,944	71,676,063

[1] Included under "Combined States."

TABLE 11.—*Coke produced, value, number of ovens, coal charged, and average yield in the United States in 1943, by States*

[Exclusive of screenings or breeze]

State	Byproduct						
	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Alabama	8	1,490	7,334,840	72.48	5,316,455	$27,838,884	$5.24
California	1	90	561,349	56.62	317,847	(1)	(1)
Colorado	1	188	1,055,599	63.71	672,502	(1)	(1)
Illinois	10	963	5,167,869	70.15	3,625,457	29,416,984	8.11
Indiana	5	1,856	11,151,001	72.75	8,111,916	66,259,831	8.17
Maryland	1	422	2,830,204	72.78	2,059,839	(1)	(1)
Massachusetts	2	215	1,662,580	70.62	1,174,152	(1)	(1)
Michigan	7	641	4,093,256	72.03	2,948,389	22,006,821	7.46
Minnesota	3	196	1,285,285	74.41	956,396	8,076,109	8.44
New Jersey	2	226	1,415,839	71.64	1,014,268	(1)	(1)
New York	8	1,145	7,478,630	71.50	5,347,369	39,091,561	7.31
Ohio	15	2,099	14,270,530	71.97	10,270,758	64,405,750	6.27
Pennsylvania	14	3,522	24,195,206	68.27	16,518,872	91,023,147	5.51
Tennessee	1	44	357,342	71.14	254,211	(1)	(1)
Utah	2	119	408,088	58.99	240,736	(1)	(1)
Virginia	------	------	------	------	------	------	------
Washington	1	17	22,739	65.32	14,853	(1)	(1)
West Virginia	5	506	3,693,156	70.72	2,611,825	10,742,587	4.11
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	514	3,035,428	75.34	2,286,831	18,649,880	8.16
Undistributed	------	------	------	------	------	46,613,575	8.11
Total: 1943	92	14,253	90,018,941	70.81	63,742,676	424,125,129	6.65
1942	88	13,303	87,973,821	70.81	62,294,909	378,011,967	6.07

State	Beehive						Total	
	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens		Coke produced (net tons)	Value of coke at ovens
					Total	Per ton		
Alabama	494	58,116	59.66	34,674	(1)	(1)	5,351,129	(1)
California	------	------	------	------	------	------	317,847	(1)
Colorado	260	132,330	64.34	85,141	(1)	(1)	757,643	(1)
Illinois	------	------	------	------	------	------	3,625,457	$29,416,984
Indiana	------	------	------	------	------	------	8,111,916	66,259,831
Maryland	------	------	------	------	------	------	2,059,839	(1)
Massachusetts	------	------	------	------	------	------	1,174,152	(1)
Michigan	------	------	------	------	------	------	2,948,389	22,006,821
Minnesota	------	------	------	------	------	------	956,396	8,076,109
New Jersey	------	------	------	------	------	------	1,014,268	(1)
New York	------	------	------	------	------	------	5,347,369	39,091,561
Ohio	------	------	------	------	------	------	10,270,758	64,405,750
Pennsylvania	13,674	10,742,412	64.55	6,934,445	$44,864,084	$6.47	23,453,317	135,887,231
Tennessee	240	82,221	59.43	48,861	(1)	(1)	303,072	(1)
Utah	797	193,254	43.51	84,003	(1)	(1)	324,829	(1)
Virginia	751	500,311	58.63	293,324	2,051,662	6.99	293,324	2,051,662
Washington	------	------	------	------	------	------	14,853	(1)
West Virginia	1,250	684,313	61.89	423,551	2,770,853	6.54	3,035,376	13,513,440
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	200	48,107	60.90	29,298	(1)	(1)	2,316,129	(1)
Undistributed	------	------	------	------	2,305,744	8.17	------	95,408,083
Total: 1943	17,666	12,441,064	63.77	7,933,387	51,902,343	6.55	71,676,063	476,117,472
1942	16,295	12,875,812	64.26	8,274,035	47,601,777	5.75	70,568,944	425,613,744

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[1] Included under "Undistributed."

TABLE 12.—*Byproduct coke produced in Ohio in 1943, by districts*

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Canton, Cleveland, and Massillon	5	670	4, 269, 185	73. 75	3, 148, 373	$21, 487, 058	$6. 82
Youngstown	3	602	4, 105, 107	70. 53	2, 895, 234	15, 455, 255	5. 34
Other districts [1]	7	827	5, 896, 238	71. 69	4, 227, 151	27, 463, 437	6. 50
	15	2, 099	14, 270, 530	71. 97	10, 270, 758	64, 405, 750	6. 27

[1] Includes plants at Hamilton, Ironton, Lorain, Painesville, Portsmouth, Toledo, and Warren.

TABLE 13.—*Byproduct and beehive coke produced in Pennsylvania in 1943, by districts*

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Byproduct:							
Eastern Pennsylvania [1]	5	796	4, 540, 884	71. 14	3, 230, 189	$26, 323, 232	$8. 15
Western Pennsylvania [2]	9	2, 726	19, 654, 322	67. 61	13, 288, 683	64, 699, 915	4. 87
	14	3, 522	24, 195, 206	68. 27	16, 518, 872	91, 023, 147	5. 51
Beehive:							
Fayette County	51	9, 309	7, 496, 531	64. 60	4, 842, 663	30, 828, 223	6. 37
Indiana County	3	719	459, 809	63. 57	292, 299	1, 991, 866	6. 81
Westmoreland County	23	2, 937	2, 197, 871	64. 68	1, 421, 685	9, 520, 639	6. 70
All other counties [3]	4	709	588, 201	64. 23	377, 798	2, 523, 356	6. 68
	81	13, 674	10, 742, 412	64. 55	6, 934, 445	44, 864, 084	6. 47
	95	17, 196	34, 937, 618	67. 13	23, 453, 317	135, 887, 231	5. 79

[1] Includes plants at Bethlehem, Chester, Philadelphia, Steelton, and Swedeland.
[2] Includes plants at Aliquippa, Champion, Clairton, Erie, Johnstown, Midland, Monessen, Neville Island, and Pittsburgh.
[3] Comprises figures from one plant each in Beaver, Bedford, Cambria, and Greene Counties.

NUMBER AND TYPE OF OVENS

Byproduct ovens.—The tremendous expansion in blast-furnace capacity in 1943 was matched by the greatest construction program in the byproduct-coke industry since 1927. A total of 953 new byproduct ovens was completed during 1943, and 5,220,610 tons were added to the annual coke-producing capacity. Three ovens failed during the year and were reported abandoned by the operators, which resulted in a net gain of 950 ovens; at the end of the year 14,253 byproduct ovens were in existence, with an annual coke capacity of 71,378,408 tons, or 11 percent over 1942. According to reports submitted to the Bureau of Mines, 528 new ovens (with an annual coke capacity of 2,644,663 tons) were under construction at the close of the year. Of the 14,253 ovens reported in existence at the end of the year 37 percent were Koppers, 39 percent Koppers-Becker, 13 percent Semet-Solvay, 9 percent Wilputte, and the remaining 2 percent of miscellaneous types.

Beehive ovens.—In the beehive industry, 2,044 ovens—500 new and 1,544 rehabilitated—were placed in operation during the year. The number of ovens abandoned totaled 673, a net gain of 1,371 ovens over 1942, which raised the total number in existence at the close of the year to 17,666, with an annual coke capacity of 11,230,396 tons. This was an increase over 1942 of 8 percent in number of ovens and 8 percent in capacity; however, the change is not significant, since operators consider certain ovens serviceable one year and not serviceable the next, according to general conditions.

TABLE 14.—*Coke ovens completed and abandoned in the United States in 1943 and total number in existence at end of year, by States*

State	Plants in existence Dec. 31	Ovens						
		In existence Dec. 31		New		Abandoned during year	Under construction Dec. 31	
		Number	Annual capacity (net tons of coke)	Number	Annual capacity (net tons of coke)		Number	Annual capacity (net tons of coke)
Byproduct:								
Alabama	8	1,490	6,808,507	138	864,100			
California	1	90	360,000	90	360,000			
Colorado	1	188	813,300				74	327,000
Connecticut	1	70	(1)					
Illinois	10	963	4,546,935	49	303,000	1	75	405,000
Indiana	5	1,856	9,539,310	264	1,388,877			
Kentucky	1	120	(1)					
Maryland	1	422	2,101,700					
Massachusetts	2	215	1,298,500					
Michigan	7	641	3,194,596					
Minnesota	3	196	1,067,900					
Missouri	1	64	(1)					
New Jersey	2	226	991,500			2	65	360,000
New York	8	1,145	6,116,498	91	473,703			
Ohio	15	2,099	10,612,095	136	966,100			
Pennsylvania	14	3,522	18,007,400	105	543,200			
Rhode Island	1	65	(1)					
Tennessee	1	44	243,400					
Texas							125	741,373
Utah	2	119	511,880	63	270,430		189	811,290
Washington	1	17	51,200	17	51,200			
West Virginia	5	506	2,811,700					
Wisconsin	2	195	(1)					
Undistributed			2,301,987					
	92	14,253	71,378,408	953	5,220,610	3	528	2,644,663
At merchant plants	42	3,406	15,432,542	58	239,267	3	65	360,000
At furnace plants	50	10,847	55,945,866	895	4,981,343		463	2,284,663
Beehive:								
Alabama	4	494	271,500	100	40,100			
Colorado	1	260	130,000					
Kentucky	1	200	180,000	200	180,000	14		
Pennsylvania	81	13,674	9,101,896	1,134	811,881	497		
Tennessee	2	240	100,200					
Utah	2	797	430,000	500	300,000			
Virginia	5	751	394,800			2		
Washington						160		
West Virginia	11	1,250	622,000	110	55,000			
	107	17,666	11,230,396	2,044	1,386,981	673		

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[1] Included under "Undistributed."

TABLE 15.—*Average number of beehive ovens active in the United States in 1943, by months*

Month	Number	Month	Number	Month	Number
January	13,004	May	12,938	September	13,819
February	13,069	June	12,812	October	13,771
March	13,254	July	13,471	November	13,593
April	13,149	August	13,704	December	13,674

TABLE 16.—*Byproduct ovens of each type in the United States at end of 1943, by States*

State	Koppers	Koppers-Becker	Semet-Solvay	Wilputte	Cambria	American Foundation	All others [1]	Total
Alabama	459	486	420	125	----------	----------	----------	1,490
California	----------	90	----------	----------	----------	----------	----------	90
Colorado	116	72	----------	----------	----------	----------	----------	188
Connecticut	----------	70	----------	----------	----------	----------	----------	70
Illinois	380	329	120	88	----------	----------	46	963
Indiana	406	812	161	477	----------	----------	----------	1,856
Kentucky	----------	----------	120	----------	----------	----------	----------	120
Maryland	300	122	----------	----------	----------	----------	----------	422
Massachusetts	----------	160	----------	55	----------	----------	----------	215
Michigan	----------	295	346	----------	----------	----------	----------	641
Minnesota	155	41	----------	----------	----------	----------	----------	196
Missouri	56	----------	----------	----------	----------	----------	8	64
New Jersey	189	37	----------	----------	----------	----------	----------	226
New York	150	608	180	152	----------	55	----------	1,145
Ohio	1,238	431	369	61	----------	----------	----------	2,099
Pennsylvania	1,550	1,629	88	132	120	----------	3	3,522
Rhode Island	40	25	----------	----------	----------	----------	----------	65
Tennessee	----------	----------	24	20	----------	----------	----------	44
Utah	----------	119	----------	----------	----------	----------	----------	119
Washington	----------	----------	----------	----------	----------	----------	17	17
West Virginia	154	207	----------	145	----------	----------	----------	506
Wisconsin	100	15	80	----------	----------	----------	----------	195
	5,293	5,548	1,908	1,255	120	55	74	14,253
At merchant plants	770	1,105	1,062	340	----------	55	74	3,406
At furnace plants	4,523	4,443	846	915	120	----------	----------	10,847

[1] Comprises 63 Curran-Knowles, 8 Piette, and 3 Disco ovens.

CAPACITY OF BYPRODUCT PLANTS

The completion of new oven installations at byproduct plants during 1943 added 14,303 tons of coke per day to the potential maximum daily capacity of the industry; and at the end of the year the capacity of all ovens in existence, whether idle or active, totaled 195,557 tons per day. This represented an increase of 11 percent over the capacity at the beginning of the year and 15 percent over the pre-war figure of 170,467 tons at the end of 1940. Capacity, as thus stated, is defined as the total quantity of coke of the grade the operator aims to produce that can be obtained in a 24-hour period with all conditions favorable and all ovens active. This capacity is governed by operating, economic, and labor conditions and is subject to change from year to year, according to changes in coking time, coal mixtures, or other variables.

Table 17 shows the relationship between production and potential maximum capacity at byproduct-coke plants, by months, in 1929 and 1940–43. The maximum daily capacity was based upon data supplied by the operators in the annual reports, and therefore adjustments were made from time to time as new ovens were placed in operation. The rate of production has been maintained relatively constant during the past 2 years, except for slight fluctuations in 1943, when mine stoppages interrupted the flow of coal to the byproduct-coke plants.

TABLE 17.—*Relationship of production to potential maximum capacity*[1] *at byproduct-coke plants in the United States, 1929 and 1940–43, by months, in percent*

Month	1929	1940	1941	1942	1943	Month	1929	1940	1941	1942	1943
January	88.6	89.2	92.0	94.3	98.7	August	93.6	87.3	93.4	98.0	96.3
February	91.3	81.3	92.9	94.2	98.8	September	91.9	89.2	91.9	98.4	96.7
March	93.0	78.1	93.2	94.3	98.0	October	92.3	90.2	92.0	98.4	94.7
April	92.8	78.0	86.4	94.3	98.0	November	89.0	91.5	92.1	98.9	90.7
May	94.0	80.4	90.6	98.1	96.4	December	83.1	91.2	94.8	98.4	94.2
June	93.9	85.6	93.3	98.3	92.6						
July	93.0	86.1	93.7	97.6	93.3	The year	91.4	85.7	92.2	96.9	95.7

[1] Capacity of all ovens in existence, whether active or idle, based upon maximum daily capacity times days in month.

QUANTITY AND COST OF COAL CHARGED

Byproduct and beehive ovens rank next to the railroads as leading industrial consumers of bituminous coal. In 1943 the quantity of coal charged into byproduct- and beehive-coke ovens surpassed the 1942 record figure by 1,610,400 tons and reached 102,460,000 tons. Of this tonnage byproduct ovens consumed 88 and beehive ovens 12 percent. The steadily increasing expansion in coal-carbonizing capacity in the byproduct industry in 1943 increased the quantity of coal used each month and reached a maximum of 7,833,300 tons in December 1943. Indications in early 1944 pointed toward even greater requirements. Pennsylvania was the leading consumer of coking coal and used 27 percent of the coal consumed in the byproduct industry and 86 percent in the beehive industry. Ohio and Indiana were large consumers of byproduct coal and used 16 percent and 12 percent, respectively, in 1943.

The total cost of coal charged into byproduct ovens increased 11 percent in 1943 compared with 1942; the total cost of coal charged into beehive ovens increased 17 percent. The increases in cost of coking coal to coke-oven operators followed the general increases in coal prices and were governed by the terms of Maximum Price Regulation 120, issued April 29, 1942, effective May 18, 1942, and subsequent amendments.

TABLE 18.—*Coal consumed in coke ovens in the United States, 1941–43, by months, in net tons*

Month	1941			1942			1943		
	By product	Beehive	Total	By-product	Beehive	Total	By-product	Beehive	Total
January	7,021,300	860,000	7,881,300	7,400,800	1,051,000	8,451,800	7,647,600	1,038,300	8,685,900
February	6,408,900	830,600	7,239,500	6,681,700	988,700	7,670,400	6,937,700	1,048,700	7,986,400
March	7,116,400	979,800	8,096,200	7,405,400	1,080,700	8,486,100	7,613,600	1,179,200	8,792,800
April	6,367,800	155,600	6,523,400	7,164,600	1,068,900	8,233,500	7,461,200	1,073,900	8,535,100
May	6,832,500	894,100	7,726,600	7,425,900	1,089,700	8,515,600	7,640,900	1,028,400	8,669,300
June	6,816,700	931,900	7,748,600	7,199,700	1,118,300	8,318,000	7,153,200	657,900	7,811,100
July	7,067,100	955,400	8,022,500	7,451,800	1,077,900	8,529,700	7,457,300	967,200	8,424,500
August	7,067,700	1,008,700	8,076,400	7,504,900	1,084,100	8,589,000	7,733,600	1,119,500	8,853,100
September	6,775,400	948,300	7,723,700	7,290,300	1,085,700	8,376,000	7,575,200	1,116,300	8,691,500
October	7,010,200	1,012,400	8,022,600	7,538,600	1,123,700	8,662,300	7,673,300	1,146,200	8,819,500
November	6,814,600	878,600	7,693,200	7,330,400	1,038,800	8,369,200	7,292,000	953,000	8,245,000
December	7,310,300	1,073,900	8,384,200	7,579,700	1,068,300	8,648,000	7,833,300	1,112,500	8,945,800
	82,608,900	10,529,300	93,138,200	87,973,800	12,875,800	100,849,600	90,018,900	12,441,100	102,460,000

Table 19.—*Total quantity and value at ovens of coal used in manufacturing coke in the United States in 1943, by States*

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Average	Net tons	Cost
Byproduct plants:					
Alabama	7, 334, 840	$26, 390, 632	$3. 60	1. 38	$4. 97
California	561, 349	(1)	(1)	1. 77	(1)
Colorado	1, 055, 599	(1)	(1)	1. 57	(1)
Illinois	5, 167, 869	29, 043, 545	5. 62	1. 43	8. 04
Indiana	11, 151, 001	65, 206, 774	5. 85	1. 37	8. 01
Maryland	2, 830, 204	(1)	(1)	1. 37	(1)
Massachusetts	1, 662, 580	(1)	(1)	1. 42	(1)
Michigan	4, 093, 256	18, 705, 362	4. 57	1. 39	6. 35
Minnesota	1, 285, 285	7, 731, 414	6. 02	1. 34	8. 07
New Jersey	1, 415, 839	(1)	(1)	1. 40	(1)
New York	7, 478, 630	41, 797, 580	5. 59	1. 40	7. 83
Ohio	14, 270, 530	67, 485, 778	4. 73	1. 39	6. 57
Pennsylvania	24, 195, 206	95, 924, 872	3. 96	1. 46	5. 78
Tennessee	357, 342	(1)	(1)	1. 41	(1)
Utah	408, 088	(1)	(1)	1. 70	(1)
Washington	22, 739	(1)	(1)	1. 53	(1)
West Virginia	3, 693, 156	11, 785, 228	3. 19	1. 41	4. 50
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	3, 035, 428	16, 466, 708	5. 42	1. 33	7. 21
Undistributed		47, 003, 998	5. 65		8. 19
	90, 018, 941	427, 541, 891	4. 75	1. 41	6. 70
At merchant plants	20, 249, 109	105, 468, 174	5. 21	1. 37	7. 14
At furnace plants	69, 769, 832	322, 073, 717	4. 62	1. 42	6. 56
Beehive plants:					
Alabama	58, 116	(1)	(1)	1. 68	(1)
Colorado	132, 330	(1)	(1)	1. 55	(1)
Kentucky	48, 107	(1)	(1)	1. 64	(1)
Pennsylvania	10, 742, 412	32, 965, 109	3. 07	1. 55	4. 76
Tennessee	82, 221	(1)	(1)	1. 68	(1)
Utah	193, 254	(1)	(1)	2. 30	(1)
Virginia	500, 311	1, 350, 559	2. 70	1. 71	4. 62
West Virginia	684, 313	1, 977, 468	2. 89	1. 62	4. 68
Undistributed		1, 550, 310	3. 02		5. 50
	12, 441, 064	37, 843, 446	3. 04	1. 57	4. 77

[1] Included under "Undistributed."

Table 20.—*Average cost per net ton of coal charged into byproduct-coke ovens in the United States, 1929 and 1940–43, by States*

State	1929	1940	1941	1942	1943	State	1929	1940	1941	1942	1943
Alabama	$2. 49	$2. 41	$2. 79	$3. 13	$3. 60	Tennessee	$3. 02	$3. 46	$3. 67	(1)	(1)
Illinois	4. 29	4. 57	4. 92	5. 28	5. 62	Washington	5. 26				(1)
Indiana	4. 61	4. 72	5. 16	5. 50	5. 85	West Virginia	2. 41	2. 39	2. 63	$2. 92	$3. 19
Massachusetts	4. 70	(1)	(1)	(1)	(1)						
Michigan	4. 29	3. 99	4. 35	4. 87	4. 57						
Minnesota	5. 04	5. 16	5. 19	5. 64	6. 02	United States average	3. 50	3. 68	3. 92	4. 38	4. 75
New York	4. 22	4. 56	4. 87	5. 37	5. 59						
Ohio	3. 31	3. 78	4. 13	4. 41	4. 73	Cost of coal per ton of coke	5. 04	5. 23	5. 53	6. 18	6. 70
Pennsylvania	2. 73	2. 84	2. 69	3. 44	3. 96						

[1] Bureau of Mines not at liberty to publish data.

PREPARATION AND SOURCE OF COAL

Washed and unwashed.—Table 21 presents the tonnages of washed and unwashed coal used in the manufacture of byproduct and beehive coke in 1943. Coal washed, as used in this report, is defined as the separation of impurities such as dirt, shale, sulfur, and phosphorus, from raw coal by mechanical cleaning by wet or pneumatic methods. High-ash coal charged into ovens results in an even higher ash content of the coke produced and causes definite economic losses in the blast furnace.[6]

Most of the cleaning plants are at the mines, but some are at the ovens. All coal mined in Colorado, Alabama, and Washington and most of that produced in Pennsylvania, Tennessee, and Illinois and used for the manufacture of coke was washed. In 1943, 27 percent of the coal charged into byproduct ovens and 11 percent into beehive ovens was washed. The lack of mechanical cleaning equipment at small truck mines that supplied coal to beehive ovens accounted for the fact that the percentage of washed coal charged into beehive ovens was much less than for byproduct ovens.

Sources.—The geographical location of coking-coal deposits, because of its irregular and limited distribution, has vital importance to our national economy. Almost any kind of clean coal can be used for ordinary fuel, but the coke industry undoubtedly has the most stringent standards of all major coal-consuming industries. Byproduct and beehive ovens not only require coal that is relatively free from impurities, but in addition it must fuse and develop a strong porous structure when heated in ovens.

The principal sources of coking coal are Pennsylvania, West Virginia, and Kentucky, which together supplied 87 percent of all coal purchased for the manufacture of byproduct coke in the United States in 1943. Other important sources were Alabama, with 8 percent, and Virginia, Utah, Colorado, Illinois, Tennessee, New Mexico, Indiana, Washington, Georgia, and Maryland, which together furnished 5 percent.

Blending.—More and more emphasis is being placed on quality of coke, and one means of improvement is blending the coals charged.[7] This practice is designed primarily to produce, economically, coke of satisfactory quality for the use intended. It permits the use of coals that have coking properties but may be objectionable because of excessive ash, sulfur, or phosphorus and could not be used as a 100-percent charge.

Blending was practiced at 71 byproduct plants in 1943, of which 41 used high- and low-volatile coal; 22, high, medium, and low; 4, high and medium; and 4, low and medium.

The relative proportions of high-, medium-, and low-volatile coking coal purchased by byproduct-coke-plant operators has remained fairly constant during the past 3 years; and in 1943, of the 89,204,294 tons of coking coal purchased, 64 percent were high; 14 percent medium; and 22 percent low volatile.

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[6] McAleer, W. S., Coal Washing—Its Effect on Coke-Oven Blast-Furnace Practice: Iron and Steel Eng., vol. 20, No. 1, January 1943, pp. 29-35.

[7] Mabley, W. M., Foundry Coke from Blending of Southern Coals: Ind. and Eng. Chem., ind. ed., vol. 35, No. 2, February 1943, pp. 148-150.

TABLE 21.—*Washed and unwashed coal used in manufacturing coke in the United States in 1943, by States in which used, in net tons*

State	Washed	Unwashed	Total
Byproduct plants:			
Alabama	7, 201, 504	133, 336	7, 334, 840
California		561, 349	561, 349
Colorado	1, 055, 599		1, 055, 599
Illinois	508, 055	4, 659, 814	5, 167, 869
Indiana		11, 151, 001	11, 151, 001
Maryland		2, 830, 204	2, 830, 204
Massachusetts		1, 662, 580	1, 662, 580
Michigan	289, 006	3, 804, 250	4, 093, 256
Minnesota	31, 607	1, 253, 678	1, 285, 285
New Jersey		1, 415, 839	1, 415, 839
New York	897, 516	6, 581, 114	7, 478, 630
Ohio	3, 080, 677	11, 189, 853	14, 270, 530
Pennsylvania	9, 497, 131	14, 698, 075	24, 195, 206
Tennessee	214, 405	142, 937	357, 342
Utah		408, 088	408, 088
Washington	13, 776	8, 963	22, 739
West Virginia	1, 155, 633	2, 537, 523	3, 693, 156
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	12, 347	3, 023, 081	3, 035, 428
	23, 957, 256	66, 061, 685	90, 018, 941
At merchant plants	2, 442, 436	17, 806, 673	20, 249, 109
At furnace plants	21, 514, 820	48, 255, 012	69, 769, 832
Beehive plants:			
Alabama	58, 116		58, 116
Colorado	132, 330		132, 330
Kentucky		48, 107	48, 107
Pennsylvania	1, 095, 440	9, 646, 972	10, 742, 412
Tennessee	56, 522	25, 699	82, 221
Utah		193, 254	193, 254
Virginia		500, 311	500, 311
West Virginia		684, 313	684, 313
	1, 342, 408	11, 098, 656	12, 441, 064

TABLE 22.—*Coal purchased for manufacturing byproduct coke in the United States in 1943, by fields of origin, in net tons*

State and district where coal was produced	Total purchased	States where coal was consumed—in order of importance
Alabama	7, 268, 848	Alabama.
Colorado	964, 594	Colorado.
Georgia	6, 870	Tennessee.
Illinois	514, 394	Indiana and Illinois.
Indiana	78, 607	Illinois and Wisconisn.
Kentucky:		
Elkhorn	3, 184, 250	Indiana, Ohio, New York, Michigan, Illinois, Pennsylvania, New Jersey, Minnesota, Wisconsin, Kentucky, and Connecticut.
Harlan	5, 479, 889	Indiana, Ohio, Illinois, Minnesota, Pennsylvania, Michigan, and New York.
Kenova	162, 801	Massachusetts.
Thacker	1, 834, 108	Michigan, Ohio, Wisconsin, and Massachusetts.
Miscellaneous	583, 154	Illinois and Ohio.
Maryland	786	Pennsylvania.
New Mexico	239, 916	Colorado and California.
Pennsylvania:		
Anthracite	27, 312	Illinois and Missouri.
Central Pennsylvania:		
High-volatile	157, 746	New York.
Medium-volatile	428, 337	New York and Pennsylvania.
Low-volatile	3, 482, 556	Pennsylvania, Ohio, and New York.
Connellsville	14, 904, 387	Pennsylvania, Ohio, West Virginia, New York, and Illinois.
Freeport	1, 839, 279	West Virginia, Ohio, Michigan, and Pennsylvania.
Pittsburgh	11, 574, 764	Pennsylvania, New York, Ohio, Michigan, Illinois, and Wisconsin.
Somerset	543, 965	Pennsylvania, West Virginia, and New York.
Westmoreland	1, 274, 962	Pennsylvania, Maryland, Minnesota, Ohio, and New York.

TABLE 22.—*Coal purchased for manufacturing byproduct coke in the United States in 1943, by fields of origin, in net tons*—Continued

State and district where coal was produced	Total purchased	States where coal was consumed—in order of importance
Tennessee	343, 043	Tennessee.
Utah	1, 019, 764	California, Utah, and Washington.
Virginia [1]	804, 238	Michigan, Ohio, New Jersey, New York, Pennsylvania, and Wisconsin.
Washington	13, 776	Washington.
West Virginia:		
Coal and Coke	123, 237	Pennsylvania.
Coal River	261, 119	Illinois.
Kanawha	7, 075, 082	Ohio, Illinois, Pennsylvania, Kentucky, Indiana, West Virginia, Massachusetts, New York, Connecticut, Missouri, Minnesota, New Jersey, Wisconsin, Michigan, Rhode Island, and Tennessee.
Logan	2, 590, 570	Ohio, Indiana, Wisconsin, Michigan, Massachusetts, New York, Illinois, Rhode Island, Minnesota, Connecticut, and Kentucky.
New River:		
High-volatile	1, 354, 385	New Jersey, New York, Pennsylvania, Rhode Island, and Michigan.
Medium-volatile	663, 628	Massachusetts, Connecticut, and New York.
Low-volatile	878, 905	New Jersey, Maryland, New York, Michigan, Minnesota, West Virginia, and Pennsylvania.
Northern	4, 715, 589	Maryland, Pennsylvania, West Virginia, Michigan, Ohio, and New York.
Pocahontas [1]	12, 806, 101	Indiana, Ohio, Illinois, Michigan, Pennsylvania, Maryland, New York, Minnesota, Kentucky, Wisconsin, Connecticut, Missouri, Alabama, West Virginia, and Tennessee.
Tug River	145, 181	Ohio.
Webster-Gauley	489, 316	New York, Pennsylvania, Maryland, New Jersey, and Ohio.
Williamson	21, 934	Ohio and Pennsylvania.
Winding Gulf	1, 346, 901	Massachusetts, Michigan, Ohio, New York, Illinois, Rhode Island, and Wisconsin.
	89, 204, 294	

[1] 727,222 tons of Pocahontas coal produced in Virginia included in Pocahontas field of West Virginia.

Table 23.—*Coal purchased for manufacturing byproduct coke in the United States in 1943, by States where produced and where consumed and by merchant and furnace plants, in net tons*

State where coal was consumed	Coal produced in—														
	Alabama	Colorado	Georgia	Illinois	Indiana	Kentucky	Maryland	New Mexico	Pennsylvania	Tennessee	Utah	Virginia	Washington	West Virginia	Total
Alabama: Merchant plants	1,496,182													104,016	1,600,198
Furnace plants	5,772,666													9,725	5,782,391
Total Alabama	7,268,848													113,741	7,382,589
California: Furnace plant								2,055			587,827				589,882
Colorado: Furnace plant		964,594						237,861							1,202,455
Illinois: Merchant plants				218,496		23,827			51,599					698,218	992,140
Furnace plants					69,145	1,484,369			405,007					2,066,770	4,025,291
Total Illinois				218,496	69,145	1,508,196			456,606					2,764,988	5,017,431
Indiana: Merchant plants														1,061,636	1,061,636
Furnace plants				295,898		4,367,842						722,331		4,340,916	9,726,987
Total Indiana				295,898		4,367,842						722,331		5,402,552	10,788,623
Maryland: Furnace plant									140,758					2,571,929	2,712,687
Massachusetts: Merchant plants						180,932								1,479,799	1,660,731
Michigan: Merchant plants						87,006			258,975			125,304		650,205	1,121,490
Furnace plants						1,635,250			279,921			208,683		1,102,736	3,226,590
Total Michigan						1,722,256			538,896			333,987		1,752,941	4,348,080
Minnesota: Merchant plant						59,737			34,064					340,339	434,140
Furnace plants						474,477								356,196	830,673
Total Minnesota						534,214			34,064					696,535	1,264,813
New Jersey: Merchant plants						89,904						150,780		1,098,996	1,339,680
New York: Merchant plants						290,119			1,840,173			98,691		1,739,041	3,968,024
Furnace plants									2,607,396					410,080	3,017,476
Total New York						290,119			4,447,569			98,691		2,149,121	6,985,500

TABLE 23.—*Coal purchased for manufacturing byproduct coke in the United States in 1943, by States where produced and where consumed and by merchant and furnace plants, in net tons*—Continued

State where coal was consumed	Coal produced in—														
	Alabama	Colorado	Georgia	Illinois	Indiana	Kentucky	Maryland	New Mexico	Pennsylvania	Tennessee	Utah	Virginia	Washington	West Virginia	Total
Ohio: Merchant plants						139,896						201,917		1,323,325	1,665,138
Furnace plants						2,077,350			5,322,663					4,487,740	11,887,753
Total Ohio						2,217,246			5,322,663			201,917		5,811,065	13,552,891
Pennsylvania: Merchant plants									125,500					819,691	945,191
Furnace plants						277,592	786		21,035,387			18,797		2,776,015	24,108,577
Total Pennsylvania						277,592	786		21,160,887			18,797		3,595,706	25,053,768
Tennessee: Merchant plant			6,870							343,043		4,891		12,720	367,524
Utah: Furnace plants											422,974				422,974
Washington: Merchant plant											8,963		13,776		22,739
West Virginia: Merchant plants									7,712					1,465,872	1,473,584
Furnace plants									2,085,037					17,635	2,102,672
Total West Virginia									2,092,749					1,483,507	3,576,256
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants					9,462	55,901			39,116			66		2,811,126	2,915,671
	7,268,848	964,594	6,870	514,394	78,607	11,244,202	786	239,916	34,233,308	343,043	1,019,764	1,531,460	13,776	31,744,726	89,204,294
At merchant plants	1,496,182		6,870	218,496	9,462	927,322			2,357,139	343,043	8,963	581,649	13,776	13,604,984	19,567,886
At furnace plants	5,772,666	964,594		295,898	69,145	10,316,880	786	239,916	31,876,169		1,010,801	949,811		18,139,742	69,636,408

TABLE 24.—*Coal purchased for manufacturing byproduct coke in the United States in 1943, by States where consumed and by volatile content* [1]

State where coal was consumed	Low volatile		Medium volatile		High volatile		Total coal purchased (net tons)
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	
Alabama: Merchant plants	104,016	6.5	1,126,102	70.4	370,080	23.1	1,600,198
Furnace plants	9,725	.2	5,543,588	95.8	229,078	4.0	5,782,391
Total Alabama	113,741	1.5	6,669,690	90.4	599,158	8.1	7,382,589
California: Furnace plant					589,882	100.0	589,882
Colorado: Furnace plant			837,268	69.6	365,187	30.4	1,202,455
Illinois: Merchant plants	247,668	25.0	448,134	45.1	296,338	29.9	992,140
Furnace plants	1,171,621	29.1	404,292	10.0	2,449,378	60.9	4,025,291
Total Illinois	1,419,289	28.3	852,426	17.0	2,745,716	54.7	5,017,431
Indiana: Merchant plants	395,869	37.3	665,767	62.7			1,061,636
Furnace plants	4,341,266	44.6			5,385,721	55.4	9,726,987
Total Indiana	4,737,135	43.9	665,767	6.2	5,385,721	49.9	10,788,623
Maryland: Furnace plant	721,802	26.6	624,271	23.0	1,366,614	50.4	2,712,687
Massachusetts: Merchant plants	326,802	19.6	525,001	31.6	808,928	48.8	1,660,731
Michigan: Merchant plants	406,479	36.2			715,011	63.8	1,121,490
Furnace plants	646,062	20.0			2,580,528	80.0	3,226,590
Total Michigan	1,052,541	24.2			3,295,539	75.8	4,348,080
Minnesota: Merchant plant	116,738	26.8	38,310	8.8	279,092	64.4	434,140
Furnace plants	356,196	42.9			474,477	57.1	830,673
Total Minnesota	472,934	37.4	38,310	3.0	753,569	59.6	1,264,813
New Jersey: Merchant plants	272,186	20.3	433,201	32.3	634,293	47.4	1,339,680
New York: Merchant plants	548,687	13.8	462,838	11.7	2,956,499	74.5	3,968,024
Furnace plants	471,747	15.6	442,905	14.7	2,102,824	69.7	3,017,476
Total New York	1,020,434	14.6	905,743	13.0	5,059,323	72.4	6,985,500
Ohio: Merchant plants	456,482	27.4	146,330	8.8	1,062,326	63.8	1,665,138
Furnace plants	3,601,010	30.3	319,716	2.7	7,967,027	67.0	11,887,753
Total Ohio	4,057,492	29.9	466,046	3.4	9,029,353	66.7	13,552,891
Pennsylvania: Merchant plants	174,719	18.5	243,193	25.7	527,279	55.8	945,191
Furnace plants	3,790,354	15.7	26,365	.1	20,291,858	84.2	24,108,577
Total Pennsylvania	3,965,073	15.8	269,558	1.1	20,819,137	83.1	25,053,768
Tennessee: Merchant plant	11,761	3.2	343,043	93.3	12,720	3.5	367,524
Utah: Furnace plants					422,974	100.0	422,974
Washington: Merchant plant			13,776	60.6	8,963	39.4	22,739
West Virginia: Merchant plants	69,582	4.7	7,712	.5	1,396,290	94.8	1,473,584
Furnace plants	186,495	8.9			1,916,177	91.1	2,102,672
Total West Virginia	256,077	7.2	7,712	.2	3,312,467	92.6	3,576,256
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants	801,785	27.5	186,239	6.4	1,927,647	66.1	2,915,671
	19,229,052	21.6	12,838,051	14.4	57,137,191	64.0	89,204,294
At merchant plants	3,932,774	20.1	4,639,646	23.7	10,995,466	56.2	19,567,886
At furnace plants	15,296,278	22.0	8,198,405	11.8	46,141,725	66.2	69,636,408

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[1] Low volatile—dry V. M. 22 percent or less and more than 14 percent; medium volatile—dry V. M. 31 percent or less and more than 22 perecnt; high volatile—dry V. M. more than 31 percent.

YIELD OF COKE PER TON OF COAL

TABLE 25.—*Yield of coke from coal in byproduct and beehive ovens in the United States, 1940–43, by States, in percent*

State	1940		1941		1942		1943	
	Byproduct	Beehive	Byproduct	Beehive	Byproduct	Beehive	Byproduct	Beehive
Alabama	71.03		71.51	60.66	71.71	61.45	72.48	59.66
Colorado	63.95	65.20	65.13	64.57	66.24	63.87	63.71	64.34
Illinois	70.56		71.20		70.63		70.15	
Indiana	73.24		73.31		72.31		72.75	
Maryland	72.33		72.60		72.42		72.78	
Massachusetts	71.11		70.36		70.49		70.62	
Michigan	70.06		71.31		72.00		72.03	
Minnesota	70.50		72.13		75.17		74.41	
New Jersey	71.67		71.65		72.16		71.64	
New York	71.34		71.39		71.40		71.50	
Ohio	71.48		71.64		72.18		71.97	
Pennsylvania	68.43	63.80	68.41	64.06	68.27	64.73	68.27	64.55
Tennessee	70.51	59.55	71.94	59.19	71.10	59.01	71.14	59.43
Utah	59.31	50.89	59.58	50.95	59.87	51.07	58.99	43.51
Virginia		59.97		60.02		59.96		58.63
Washington		60.20					65.32	
West Virginia	69.05	65.79	69.07	62.09	69.78	62.31	70.72	61.89
United States average	70.53	63.66	70.79	63.67	70.81	64.26	70.81	63.77

COKE BREEZE

In the manufacture of coke there is inevitably produced a certain quantity of fines or screenings unsuitable for furnace or foundry use and in but little demand as a domestic fuel. This material, known to the trade as breeze, irrespective of whether produced at byproduct or at beehive plants, is that portion of the small coke that remains after all large sizes (usually one-half inch and over) are removed by screening or hand forking. At byproduct plants it may be defined as the next size smaller than pea coke—that is, coke passing through a ½- or ¾-inch screen, since there is no standard screen size. At beehive plants it is that coke which passes through the tines of the loading forks or the screens of the loading machines, and its dimensions therefore vary.

Table 26 indicates that in the byproduct industry uses for breeze can usually be found and the quantity wasted is negligible, but in the beehive industry the problem of finding a profitable outlet for breeze remains unsolved. As the low value per ton will not justify long rail hauls, breeze is generally used at or near producers' plants. Of the 4,789,569 tons recovered at byproduct plants in 1943, 3,685,784 tons (77 percent) were used by the producers—3,068,273 tons for steam raising and 617,511 tons for other purposes, including producer-gas and water-gas manufacture. The quantity sold by producers increased 39 percent over 1942 and totaled 1,291,909 tons.

The total quantity of beehive-coke breeze recovered declined slightly in 1943 from the 1942 figure of 151,653 tons and totaled 151,343 tons. Breeze produced per ton of coal charged averaged 3 percent in 1943 at plants actually recovering. Since but little of the breeze actually produced was recovered at beehive plants, this material was treated as waste matter or "ash" and allowed to accumulate in piles or dumps. This practice doubtless has allowed many fragments of a size large enough for domestic use to accumulate. The shortage of domestic fuel and the stimulus of high prices which pre-

TABLE 26.—*Coke breeze recovered at coke plants in the United States in 1943, by States*

State	Yield per ton of coal (percent) [1]	Produced		Used by producer				Sold		Wasted (net tons)	On hand Dec. 31 (net tons)
				For steam raising		For other purposes, including water gas					
		Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value		
Byproduct plants:											
Alabama	4.39	321,774	$859,504	169,402	$319,182	47,066	$120,040	174,931	$583,709		9,210
California	9.80	55,006	(2)			16,211	(2)	5,013	(2)		33,782
Colorado	10.16	107,218	(2)	33,615	(2)	18,079	(2)	52,275	(2)		3,960
Illinois	6.65	343,874	953,951	127,402	317,210	12,133	29,060	198,622	593,199		81,134
Indiana	4.10	457,088	1,348,626	294,363	897,121	100,589	272,603	180,873	593,388		162,091
Maryland	6.44	182,286	(2)	78,864	(2)	28,116	(2)	67,517	(2)		89,253
Massachusetts	6.96	115,660	(2)	100,411	(2)	5,594	(2)	3,678	(2)		14,222
Michigan	4.75	194,261	991,462	155,089	862,415	19,304	90,460	48,270	219,857		14,716
Minnesota	5.63	72,370	232,261	27,618	85,989	15,400	46,970	13,410	49,578		38,691
New Jersey	6.35	89,917	(2)	87,816	(2)			215	(2)		3,870
New York	4.80	358,699	1,198,683	261,045	795,395	50,313	194,711	83,582	372,872		83,025
Ohio	5.59	797,393	1,915,225	478,460	1,110,502	210,726	526,344	210,611	555,084	4,901	99,165
Pennsylvania	5.83	1,405,461	2,453,317	1,082,091	1,867,733	64,390	118,235	161,209	287,625		591,631
Tennessee	4.40	15,717	(2)			3,953	(2)	10,272	(2)		5,187
Utah	6.37	26,009	(2)	107	(2)	6,998	(2)	22,321	(2)		2,659
Washington	8.94	2,034	(2)					1,437	(2)		597
West Virginia	3.59	86,584	126,887	67,486	101,165	17,840	25,762	8,033	9,256		13,171
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5.21	158,218	517,768	104,504	344,982	799	1,998	49,640	163,084		31,856
Undistributed			1,608,880		764,267		185,101		492,424		
Total byproduct, 1943	5.40	4,789,569	12,206,564	3,068,273	7,465,961	617,511	1,611,284	1,291,909	3,920,076	4,901	1,278,220
At merchant plants	5.46	1,030,983	3,301,747	660,699	2,061,848	48,726	166,653	310,211	1,095,485	4,901	172,421
At furnace plants	5.39	3,758,586	8,904,817	2,407,574	5,404,113	568,785	1,444,631	981,698	2,824,591		1,105,796
Total byproduct, 1942	5.30	4,600,030	10,897,121	3,123,066	7,008,139	556,690	1,302,865	932,122	2,555,985	2,261	655,175
Beehive plants:											
Alabama	8.97	5,211	(2)	5,211	(2)						
Colorado	4.55	6,023	(2)			6,023	(2)				
Kentucky											
Pennsylvania	3.26	133,214	147,485	22,797	(2)			60,301	63,288	50,714	4,848
Tennessee											
Utah	.99	1,904	(2)					141	(2)	1,763	
Virginia	.27	865	(2)			115	(2)	750	(2)		20
West Virginia	1.60	4,126	4,827							4,126	
Undistributed			25,320		35,904		10,600		4,230		
Total beehive, 1943	3.00	151,343	177,632	28,008	35,904	6,138	10,600	61,192	67,518	[3] 56,603	4,868

[1] Yield computed by dividing production of breeze by coal charged at plants actually recovering.

[2] Included under "Undistributed."

[3] As reported; quantity produced but not used was undoubtedly greater. See Mineral Resources of the United States, 1922, pt. 2, pp. 726–727.

vailed in 1943 directed attention to the huge breeze dumps in the Connellsville region, and appreciable quantities of the material were reclaimed. The practice had assumed such proportions by the latter part of the year that the Bureau of Mines initiated a monthly canvass of the new industry, beginning in October. The Office of Price Administration established maximum prices on two sizes, ½ by 1 inch and 1 inch and over. By the end of the year there were 10 operations, and the total quantity recovered and shipped was 210,751 tons valued at $868,143 (table 27).

TABLE 27.—*Shipments and value of coke recovered from beehive-breeze dumps in Pennsylvania in 1943, by sizes*

Month	½ to 1 inch			1 inch plus			Total		
	Net tons	Value		Net tons	Value		Net tons	Value	
		Total	Average		Total	Average		Total	Average
Production before and through October	54,214	$185,407	$3.42	22,235	$118.764	$5.34	76,449	$304,171	$3.98
November	48,029	176,017	3.66	20.535	110,919	5.40	68,564	286,936	4.18
December	42,420	155,066	3.66	23.318	121,970	5.23	65,738	277,036	4.21
	144,663	516,490	3.57	66.088	351.653	5.32	210,751	868,143	4.12

CONSUMPTION OF COKE

The unprecedented activity in all branches of industry throughout 1943 resulted in the largest consumption of coke ever recorded. The indicated consumption of byproduct and beehive coke in the United States was 71,406,532 tons, an increase of 1,299,314 tons over 1942. According to figures compiled by the American Iron and Steel Institute, 56,701,419 tons (79 percent) of this quantity were consumed in iron blast furnaces in the manufacture of pig iron and ferro-alloys. The remaining 21 percent was consumed in foundries, in nonferrous smelters, in water-gas plants, for other miscellaneous industrial uses, and for domestic heating.

The upward trend of fuel consumption per ton of pig iron produced continued in 1943. As shown by table 29, the quantity of coke required to make 1 ton of pig iron increased from an average of 1,791.4 pounds in 1942 to 1,800.6 pounds.

TABLE 28.—*Coke consumed in manufacture of pig iron and for other purposes in the United States, 1913, 1918, and 1940–43, in net tons*

Year	Total production	Imports	Exports	Net change in stocks	Indicated United States consumption [1]	Consumed by iron furnaces [2]		Remainder consumed in other ways	
						Quantity	Percent	Quantity	Percent
1913	46,299,530	101,212	987,395	(3)	45,413,347	37,192,287	81.9	8,221,060	18.1
1918	56,478,372	30,168	1,687,824	(3)	54,820,716	45,703,594	83.4	9,117,122	16.6
1940	57,072,134	112,550	804,095	−645,657	57,026,246	41,839,039	73.4	15,187,207	26.6
1941	65,186,578	267,886	708,971	−198,356	64,943,849	49,469,972	76.2	15,473,877	23.8
1942	70,568,944	108,819	839,582	−269,037	70 107,218	54,694,746	78.0	15,412,472	22.0
1943	71,676,063	98,127	994,607	−626,949	71,406,532	56,701,419	79.4	14,705,113	20.6

[1] Production plus imports minus exports, plus or minus decrease or increase, respectively, of net changes in stocks.

[2] From Report of American Iron and Steel Institute. Figures include coke consumed in manufacture of ferro-alloys.

[3] Data not available.

TABLE 29.—*Coke and coking coal consumed per net ton of pig iron made in the United States, 1913, 1918, and 1940–43*

Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)	Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)
1913	2,172.6	66.9	3,247.5	1941	1,767.8	70.0	2,525.4
1918	2,120.7	66.4	3,193.8	1942	1,822.8	70.0	2,604.0
1940	1,781.2	70.1	2,540.9	1943	1,834.3	70.0	2,620.4

[1] From Report of American Iron and Steel Institute; consumption per ton of pig iron only, excluding furnaces making ferro-alloys, was 2,172.6 pounds in 1913, 2,120.7 in 1918, 1,756.9 in 1940, 1,745.2 in 1941, 1,791.4 in 1942, and 1,800.6 in 1943.

FURNACE, FOUNDRY, DOMESTIC, AND OTHER COKE

Distribution, by major uses, of byproduct and beehive coke as reported by operators is shown in tables 30 and 31. Records on the distribution, by uses, are important because of the light they throw on the trends in coke consumption. Not all producers, especially those that sell through middlemen, can furnish precise information on the ultimate use of the portion they sell, but the Bureau of Mines does ask for the use to which that part of the output consumed by the producers is put and also for separation of the sales into the broad classification "furnace," "foundry," "domestic," and "other industrial."

Furnace coke is usually run-of-oven coke from which all fine coke or breeze has been removed. Foundry coke is ordinarily a blocky coke of maximum size much larger than furnace coke and from which all sizes under one-half to 3 inches have been screened out. Domestic coke generally includes a mixture of sizes approximately 3 inches and under, exclusive of breeze. It may result from the screening of foundry or furnace coke; or, where the principal demand is for domestic coke, it may be obtained by crushing the larger fragments. A majority of byproduct-coke plants are equipped to screen and size domestic coke, but most of the beehive plants are not so equipped.

In 1943, 37,519,071 tons (59 percent) of the byproduct-coke output were used by producers. Of this quantity, 92 percent was used in blast furnaces and the remainder (8 percent) for other miscellaneous purposes. Byproduct-coke sales for furnace use, including coke sold to financially affiliated corporations, increased 129 percent over 1942. Sales of byproduct foundry coke approximated sales in 1942 and totaled 2,217,499 tons. Byproduct coke sold for other industrial uses, including that sold for water-gas manufacture, increased 6 percent over 1942. The quantity of byproduct coke sold for domestic use decreased 20 percent.

Unlike producers of byproduct coke, who use the bulk of the output from their ovens, beehive producers in 1943 used but 8 percent of their output. Sales of beehive-furnace coke totaled 6,249,035 tons in 1943 compared with 6,429,279 tons in 1942. The pattern of sales of the beehive coke for foundry, other industrial, and domestic use in 1943 varied only slightly from that in 1942.

TABLE 30.—*Byproduct coke produced and sold or used by producer in the United States in 1943, by States*

[Exclusive of screenings or breeze]

State	Produced		Used by producer in blast furnaces [1]		Sold									
					Furnace [2]		Foundry		Domestic use		Industrial and other use (including water gas) [3]		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	5, 316, 455	$27, 838, 884	4, 004, 052	$18, 781, 873	691, 175	$4, 268, 103	331, 808	$2, 797, 601	117, 888	$573, 017	316, 949	$2, 024, 443	1, 457, 820	$9, 663, 164
California	317, 847	(4)	279, 317	(4)	11, 958	(4)	--------	--------	--------	--------	--------	--------	11, 958	(4)
Colorado	672, 502	(4)	657, 572	(4)	--------	--------	2, 312	(4)	324	(4)	11, 326	(4)	13, 962	(4)
Illinois	3, 625, 457	29, 416, 984	1, 825, 889	14, 204, 227	1, 059, 557	8, 829, 333	317, 695	(4)	343, 248	2, 281, 149	112, 368	(4)	1, 832, 868	15, 445, 287
Indiana	8, 111, 916	66, 259, 831	5, 520, 654	44, 678, 824	2, 005, 398	16, 301, 591	320, 036	(4)	102, 635	619, 102	115, 910	(4)	2, 543, 979	21, 194, 564
Maryland	2, 059, 839	(4)	2, 078, 124	(4)	--------	--------	--------	--------	--------	--------	36	(4)	36	(4)
Massachusetts	1, 174, 152	(4)	118, 312	(4)	211, 726	(4)	56, 203	(4)	805, 294	(4)	55, 022	(4)	1, 128, 245	(4)
Michigan	2, 948, 389	22, 006, 821	1, 346, 394	8, 969, 848	556, 512	4, 184, 189	315, 842	(4)	478, 027	3, 511, 200	277, 253	(4)	1, 627, 634	13, 213, 461
Minnesota	956, 396	8, 076, 109	498, 533	3, 922, 028	77, 942	(4)	10, 571	(4)	363, 205	3, 312, 875	43, 679	(4)	495, 397	4, 524, 302
New Jersey	1, 014, 268	(4)	258, 776	(4)	56, 582	(4)	45, 716	(4)	313, 516	(4)	364, 114	(4)	779, 928	(4)
New York	5, 347, 369	39, 091, 561	2, 151, 648	16, 020, 919	1, 988, 851	13, 235, 239	--------	--------	948, 543	7, 748, 474	281, 692	2, 254, 261	3, 219, 086	23, 237, 974
Ohio	10, 270, 758	64, 405, 750	7, 829, 983	49, 910, 297	1, 604, 266	10, 089, 417	274, 859	2, 410, 365	288, 957	1, 693, 277	288, 276	1, 746, 243	2, 456, 358	15, 939, 302
Pennsylvania	16, 518, 872	91, 023, 147	8, 433, 140	50, 119, 392	7, 438, 431	35, 466, 589	175, 803	1, 891, 197	362, 552	2, 770, 488	236, 365	1, 736, 248	8, 213, 151	41, 864, 522
Tennessee	254, 211	(4)	--------	--------	152, 788	(4)	44, 452	(4)	--------	--------	57, 534	(4)	254, 774	(4)
Utah	240, 736	(4)	162, 454	(4)	12, 094	(4)	--------	--------	1, 973	(4)	66, 351	(4)	80, 418	(4)
Washington	14, 853	(4)	--------	--------	--------	--------	--------	--------	13, 462	(4)	1, 250	(4)	14, 712	(4)
West Virginia	2, 611, 825	10, 742, 587	2, 155, 237	8, 398, 418	285, 237	(4)	61, 535	(4)	38, 276	140, 872	58, 111	(4)	443, 159	2, 298, 007
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2, 286. 831	18, 649, 880	198, 986	1, 470, 314	1, 019, 207	6, 581, 964	260, 667	2, 963, 673	606, 190	5, 945, 760	271, 681	2, 345, 799	2, 157, 745	17, 837, 196
Undistributed	--------	46, 613, 575	--------	27, 134, 789	--------	5, 535, 264	--------	12, 494, 904	--------	10, 696, 671	--------	8, 906, 047	--------	20, 137, 576
Grand total, 1943	63, 742, 676	424, 125, 129	37, 519, 071	243, 610, 929	17,171,724	104,491,689	2, 217, 499	22, 557, 740	4, 784, 090	39, 292, 885	2, 557, 917	19, 013, 041	26, 731, 230	185, 355, 355
At merchant plants	14, 750, 033	114, 280, 452	2, 774, 301	16, 668, 201	4,555,675	32, 840, 846	1, 670, 131	17, 268, 088	4, 099, 569	34, 911, 319	1, 963, 671	15, 285, 134	12, 289, 046	100, 305, 387
At furnace plants	48, 992, 643	309, 844, 677	34, 744, 770	226, 942, 728	12,616,049	71, 650, 843	547, 368	5, 289, 652	684, 521	4, 381, 566	594, 246	3, 727, 907	14, 442, 184	85, 049, 968
Grand total, 1942	62, 294, 909	378, 011, 967	44, 354, 642	246, 774, 609	7, 487, 582	45, 349, 578	2, 250, 564	22, 853, 858	5, 963, 474	46, 967, 968	2, 404, 323	17, 559, 705	18, 105, 943	132, 731, 109

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[1] Includes 57,140 tons valued at $394,972 used in foundries; 884,053 tons, $5,812,963 used to make producer gas; 1,771,786 tons, $9,834,079 used to make water gas; and 309,297 tons, $2,293,390 used for other purposes than in blast furnaces.

[2] Comprises 12,256,558 tons valued at $69,421,276 sold to financially affiliated corporations for blast-furnace use; 5,661 tons, $31,762, for foundry use; 502,409 tons, $3,212,936, for manufacture of water gas; 274,810 tons, $1,830,230, for other purposes; and 4,132,286 tons, $29,995,485, reported as merchant sales of blast-furnace coke.

[3] Includes 751,982 tons valued at $6,028,560 sold for manufacture of water gas.

[4] Included under "Undistributed."

TABLE 31.—*Beehive coke produced and sold or used by producers in the United States in 1943, by States*

State	Produced		Used by producers in blast furnaces [1]		Sold	
					Furnace [2]	
	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	34,674	(3)	40,389	(3)		
Colorado	85,141	(3)	84,742	(3)		
Kentucky	29,298	(3)			29,298	(3)
Pennsylvania	6,934,445	$44,864,084	414,034	$2,475,379	5,798,044	$37,447,849
Tennessee	48,861	(3)	40,290	(3)	10,112	(3)
Utah	84,093	(3)	65,545	(3)	5,482	(3)
Virginia	293,324	2,051,662			131,036	901,005
West Virginia	423,551	2,770,853	39	(3)	275,063	1,651,627
Undistributed		2,305,744		1,946,022		315,800
Total: 1943	7,933,387	51,992,343	645,039	4,421,401	6,249,035	40,316,281
1942	8,274,035	47,601,777	704,135	4,040,541	6,429,279	36,287,209

State	Sold—Continued							
	Foundry		Domestic use		Industrial and other use (including water gas) [4]		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama								
Colorado	203	(3)			77	(3)	280	(3)
Kentucky							29,298	(3)
Pennsylvania	237,567	$1,811,077	96,958	$598,039	377,772	$2,480,104	6,510,341	$42,337,069
Tennessee	326	(3)					10,438	(3)
Utah	340	(3)			13,519	(3)	19,341	(3)
Virginia	34,005	258,948	3,626	(3)	124,950	(3)	293,617	2,053,100
West Virginia	54,148	427,603	854	(3)	93,741	(3)	423,806	2,751,222
Undistributed		7,603		23,803		1,645,524		427,591
Total: 1943	326,589	2,505,231	101,438	621,842	610,059	4,125,628	7,287,121	47,568,982
1942	341,012	2,403,220	98,220	544,530	710,451	4,379,960	7,578,962	43,615,009

[1] Includes 89,553 tons valued at $743,785 used for other purposes than in blast furnaces.

[2] Comprises 1,538,192 tons valued at $9,426,483 sold to financially affiliated corporations for blast-furnace use and 4,710,843 tons, $30,889,798, reported as merchant sales of blast-furnace coke.

[3] Included under "Undistributed."

[4] Includes 146,682 tons valued at $977,673, sold for manufacture of water gas.

STOCKS OF COKE AND COKING COAL

Stocks of byproduct coke at producers' plants totaled 825,613 tons on January 1, 1944, a decrease of 43 percent from stocks held at the beginning of 1943. The tonnage in stock on January 1, 1944, was the lowest since the end of 1925 and reflected the abnormal demand for all grades of byproduct coke throughout the year. The combined stocks of byproduct furnace and foundry coke at the end of 1943 totaled 538,942 tons or 32 percent less than at the beginning. Domestic coke stocks dropped 57 percent in the same period and totaled 286,671 tons.

Stocks of beehive coke held by producers are normally very small and on January 1, 1944, totaled 36,487 tons. This tonnage was nearly the same as those held on January 1, 1943, and the quantity by kinds varied only slightly.

Since the production of byproduct coke is a continuous process, adequate supplies of coking coal are essential for full operation. The four general mine stoppages in 1943 interrupted the flow of coking coal and thereby reduced the stocks at many plants to dangerously low levels. In order that plants with small stocks of coal could maintain maximum production of the vitally needed coke, the Solid Fuels Administrator, pursuant to Regulation 1, promulgated May 4, 1943, ordered the diversion of coal from other users to the byproduct coke plants. Stocks of coking coal on January 1, 1943, were sufficient for 44 days' requirements at the December 1942 rate of consumption; these decreased steadily so that by the end of the year only 25 days' requirements, based upon the December 1943 rate of consumption, remained in stock. A summary showing the quantity of coking coal on hand at the end of each month in 1943 is shown in table 35.

TABLE 32.—*Stocks of furnace, foundry, and domestic coke and of breeze in the United States on January 1, 1944, by States, in net tons*

State	Coke				Breeze
	Furnace	Foundry	Domestic and other	Total	
Byproduct plants:					
Alabama	41,012	2,803	9,475	53,290	9,210
California	26,572			26,572	33,782
Colorado	6,834			6,834	3,960
Illinois	46,431	554	11,165	58,150	81,134
Indiana	34,813	1,113	11,041	46,967	162,091
Maryland	21,715			21,715	89,253
Massachusetts	430	50	70,466	70,946	14,222
Michigan	3,018	1,881	8,640	13,539	14,716
Minnesota	875	226	5,429	6,530	38,691
New Jersey			9,323	9,323	3,870
New York	59,610		104,247	163,857	83,025
Ohio	108,352	14,059	8,408	130,819	99,165
Pennsylvania	118,950	144	3,739	122,833	591,631
Tennessee	5,287			5,287	5,187
Utah	8,889		602	9,491	2,659
Washington			141	141	597
West Virginia	32,796	429	6,030	39,255	13,171
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,868	231	37,965	40,064	31,856
	517,452	21,490	286,671	[1] 825,613	1,278,220
At merchant plants	12,710	20,443	263,949	297,102	172,424
At furnace plants	504,742	1,047	22,722	528,511	1,105,796
Beehive plants:					
Alabama					
Colorado			129	129	
Kentucky					
Pennsylvania	27,413	112	3,275	30,800	4,848
Tennessee	764			764	
Utah	173	7		180	
Virginia	1,173	45	330	1,548	20
West Virginia	1,217	318	1,531	3,066	
	30,740	482	5,265	36,487	4,868

[1] Does not include 128,489 tons rescreened to breeze.

TABLE 33.—*Summary of total stocks of coke on hand at all byproduct and beehive plants in the United States on January 1, 1929, and 1940–44, in net tons*

[Exclusive of screenings or breeze]

	1929	1940	1941	1942	1943	1944
Byproduct plants:						
Furnace	750,318	597,550	525,798	697,898	770,135	517,452
Foundry	24,426	49,771	14,123	20,448	21,937	21,490
Domestic and other	1,018,205	1,922,369	1,373,213	991,045	661,401	286,671
	1,792,949	2,569,690	1,913,134	1,709,391	1,453,473	825,613
Beehive plants:						
Furnace	38,446	16,402	16,022	20,311	24,617	30,740
Foundry	8,020	8,312	3,973	4,987	2,203	482
Domestic and other	8,511	7,695	23,313	23,397	8,756	5,265
	54,977	32,409	43,308	48,695	35,576	36,487
Total:						
Furnace	788,764	613,952	541,820	718,209	794,752	548,192
Foundry	32,446	58,083	18,096	25,435	24,140	21,972
Domestic and other	1,026,716	1,930,064	1,396,526	1,014,442	670,157	291,936
	1,847,926	2,602,099	1,956,442	1,758,086	1,489,049	862,100

TABLE 34.—*Total stocks of coke at all furnace and nonfurnace byproduct plants in the United States on first of each month, 1942–43, in net tons*

[Includes furnace, foundry, and domestic, but not breeze]

Month	Furnace plants		Other plants		Total	
	1942	1943	1942	1943	1942	1943
January	825,263	825,375	884,128	628,098	1,709,391	1,453,473
February	817,492	816,300	692,293	453,141	1,509,785	1,269,441
March	869,318	756,877	516,28[illegible]	312,101	1,385,601	1,068,978
April	920,491	635,921	509,134	229,998	1,429,625	865,919
May	962,675	742,800	485,461	210,199	1,448,136	952,999
June	974,995	719,847	457,309	228,992	1,432,304	948,839
July	969,315	601,560	435,318	240,971	1,404,633	842,531
August	998,690	569,551	470,371	296,702	1,469,061	866,253
September	1,025,617	650,412	538,880	366,039	1,564,497	1,016,451
October	1,021,045	691,259	593,106	404,134	1,614,151	1,095,393
November	954,999	709,272	650,532	417,870	1,605,531	1,127,142
December	917,421	605,379	728,355	379,563	1,645,776	984,942

TABLE 35.—*Stocks of bituminous coal at byproduct-coke plants in the United States at end of each month, 1940–43, in net tons*

Month	1940	1941	1942	1943
January	6,613,253	9,886,936	8,178,962	9,952,627
February	5,978,167	9,889,674	7,888,481	9,778,403
March	5,373,567	9,853,544	7,881,459	9,850,617
April	5,217,870	4,969,862	8,408,907	9,732,267
May	5,995,170	4,725,310	9,179,025	9,219,153
June	6,506,396	5,912,874	9,866,281	7,142,587
July	7,448,266	6,215,277	9,922,306	6,818,746
August	7,831,640	7,205,844	10,238,114	6,811,435
September	8,860,832	7,291,698	10,565,801	6,590,622
October	9,711,083	8,371,329	10,997,933	6,657,479
November	10,091,259	8,327,472	11,150,840	5,819,664
December	10,184,443	8,901,462	10,721,414	6,305,514

VALUE AND PRICE

Reference has been made in previous chapters to the varying practices of coke operators financially affiliated with iron and steel plants, by which the coke sometimes is charged to the furnace department at cost and sometimes at a price that includes a percentage of profit or at the prevailing market price. For that part of the output sold, the value is the amount received for the coke, f. o. b. ovens. The total value of all coke used and sold, according to operators' reports, increased 13 percent over the 1942 figure.

According to sales data furnished by operators, average receipts per ton of byproduct coke sold in 1943 increased over 1942 as follows: Furnace $0.03, foundry $0.02, domestic $0.33, and other industrial $0.13.

Average sales realization for beehive coke in 1943 showed the following price increases per ton over 1942: $0.81 for furnace, $0.62 for foundry, $0.59 for other industrial, and $0.59 for domestic.

TABLE 36.—*Average receipts per net ton for coke sold in the United States in 1943, by States*

State	Byproduct				Beehive			
	Furnace [1]	Foundry	Domestic	Other industrial, including water gas	Furnace [1]	Foundry	Domestic	Other industrial, including water gas
Alabama	$6.18	$8.43	$4.86	$6.39				
California	(2)							
Colorado		(2)	(2)	(2)		(2)		(2)
Illinois	8.33	10.85	6.65	7.90				
Indiana	8.13	10.62	6.03	7.56				
Maryland				(2)				
Massachusetts	(2)	(2)	(2)	(2)				
Michigan	7.52	(2)	7.35	7.62				
Minnesota	(2)	(2)	9.12	(2)				
New Jersey	(2)	(2)	(2)	(2)				
New York	6.65		8.17	8.00				
Ohio	6.29	8.77	5.86	6.06				
Pennsylvania	4.77	10.76	7.64	7.35	$6.46	$7.62	$6.17	$6.56
Tennessee	(2)	(2)		(2)	(2)	(2)		
Utah	(2)		(2)	(2)	(2)	(2)		(2)
Virginia					6.88	7.61	(2)	6.99
Washington			(2)	(2)				
West Virginia	(2)	(2)	3.68	(2)	6.00	7.90	(2)	7.12
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6.46	11.37	9.81	8.63	(2)	(2)		
Undistributed	6.85	10.53	9.43	7.65	7.03	8.75	5.31	7.66
United States average	6.09	10.17	8.21	7.43	6.45	7.67	6.13	6.76
At merchant plants	7.21	10.34	8.52	7.78				
At furnace plants	5.68	9.66	6.40	6.27				

[1] Includes coke sold to affiliated corporations for all other purposes and merchant sales.
[2] Included under "Undistributed."

TABLE 37.—*Average monthly prices per net ton at ovens of spot or prompt Connellsville furnace and foundry coke, 1929 and 1940–43* [1]

Month	Furnace coke					Foundry coke				
	1929	1940	1941	1942	1943 [2]	1929	1940	1941	1942	1943
January	$2.75	$4.20	$5.50	$6.13	$6.00	$3.75	$5.50	$5.75	$6.88	$6.88
February	2.90	4.00	5.50	6.00	6.50	3.75	5.31	5.75	6.88	7.00
March	2.98	4.00	5.52	6.00	6.50	3.75	5.25	5.85	6.88	7.38
April	2.78	4.00	5.63	6.00	6.50	3.75	5.25	5.62	6.88	7.38
May	2.75	4.00	6.00	6.00	6.50	3.75	5.25	6.72	6.88	7.44
June	2.75	4.00	6.13	6.00	6.50	3.75	5.25	6.88	6.88	7.50
July	2.75	4.20	6.13	6.00	6.50	3.75	5.25	6.88	6.88	7.50
August	2.73	4.63	6.13	6.00	6.50	3.75	5.25	6.88	6.88	7.50
September	2.65	4.75	6.13	6.00	6.50	3.75	5.25	6.88	6.88	7.50
October	2.65	4.75	6.13	6.00	6.50	3.75	5.25	6.88	6.88	7.50
November	2.65	5.10	6.13	6.00	6.50	3.75	5.63	6.88	6.88	7.50
December	2.64	5.38	6.13	6.00	6.50	3.75	5.75	6.88	6.88	7.50
Average	2.75	4.42	5.92	6.01	6.46	3.75	5.35	6.49	6.88	7.37

[1] Iron Age.
[2] Operators of hand-drawn ovens using trucked coal may charge $7 effective February 3, 1943, and $7.75 effective November 29, 1943.

SHIPMENTS BY RAIL, WATER, AND TRUCK

Methods and means of shipping coke from producing plants are shown in tables 38 and 39. Tonnages are based upon reports submitted by operators as to whether coke sold was shipped by rail, water, or truck. In the byproduct industry a large part of the coke produced is consumed close to the ovens and is not loaded for shipment. In 1943 shipments of byproduct coke totaled 26,731,230 tons or approximately 42 percent of the production. Of this tonnage 84 percent moved by rail, 7 percent by water, and 9 percent by truck. Beehive ovens are usually located at the mines, and the bulk of the beehive-coke output must be transported to points of consumption. In 1943 shipments of beehive coke totaled 7,287,121 tons, equivalent to 92 percent of the annual production. Water-borne and truck shipments constituted but 2 percent and railroad shipments 98 percent of the total coke loaded.

TABLE 38.—*Beehive coke loaded for shipment on originating railroads, waterways, and trucks in the United States in 1943, by routes, as reported by producers*

Route	State	Net tons		Percent of total
		By States	Total	
Railroads:				
Baltimore & Ohio	Pennsylvania	1,455,474	1,668,376	23.0
	West Virginia	212,902		
Chesapeake & Ohio	Kentucky	29,298	77,828	1.1
	West Virginia	48,530		
Denver & Rio Grande Western	Colorado	278	17,142	.2
	Utah	16,864		
Huntingdon & Broad Top Mountain	Pennsylvania	16,335	16,335	.2
Interstate	Virginia	256,388	256,388	3.5
Ligonier Valley	Pennsylvania	79,274	79,274	1.1
Louisville & Nashville	Virginia	2,648	2,648	....
Monongahela	Pennsylvania	1,695,541	1,695,541	23.3
Nashville, Chattanooga & St. Louis	Tennessee	10,438	10,438	.1
New York Central	West Virginia	154,714	154,714	2.1
Norfolk & Western	Virginia	34,355	34,355	.5
Pennsylvania	Pennsylvania	3,040,303	3,040,303	41.7
Pittsburgh & Lake Erie	do	94,964	94,964	1.3
Western Maryland	West Virginia	7,618	7,618	.1
Total railroad shipments		7,155,924	7,155,924	98.2
Waterways: Monongahela and Ohio Rivers	Pennsylvania	106,604	106,604	1.5
Trucks		[1] 24,593	24,593	.3
Grand total		7,287,121	7,287,121	100.0

[1] Coke delivered by trucks to consumers in all States that produced beehive coke except Alabama, Kentucky, and Tennessee.

TABLE 39.—*Coke and breeze sold that was loaded at plant for shipment in the United States in 1943, by States, in net tons*

State	Coke				Breeze			
	In railroad cars	In boats	In trucks	Total	In railroad cars	In boats	In trucks	Total
Byproduct plants:								
Alabama	1,440,395		17,425	1,457,820	166,337		8,594	174,931
California	11,958			11,958	5,013			5,013
Colorado	13,937		25	13,962	52,022		253	52,275
Illinois	1,719,139		113,729	1,832,868	179,618	6,237	12,767	198,622
Indiana	2,502,549		41,430	2,543,979	154,042		26,831	180,873
Maryland	36			36	1,541	65,976		67,517
Massachusetts	543,474	18,115	566,656	1,128,245			3,678	3,678
Michigan	1,286,172	125,292	216,170	1,627,634	47,438	832		48,270
Minnesota	451,576		43,821	495,397	13,410			13,410
New Jersey	384,053	159,495	236,380	779,928			215	215
New York	2,355,122	176,076	687,888	3,219,086	82,650	683	249	83,582
Ohio	2,160,266	258,060	38,032	2,456,358	191,300	19,282	29	210,611
Pennsylvania	7,025,842	987,290	200,019	8,213,151	137,224	22,712	1,273	161,209
Tennessee	254,774			254,774	10,272			10,272
Utah	76,989		3,429	80,418	22,300		21	22,321
Washington	7,069	7,643		14,712	1,437			1,437
West Virginia	438,020		5,139	443,159	8,033			8,033
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,737,094	131,239	289,412	2,157,745	31,586	6,081	11,973	49,640
	22,408,465	1,863,210	2,459,555	26,731,230	1,104,223	121,803	65,883	1,291,909
At merchant plants	9,432,172	695,443	2,161,431	12,289,046	245,542	34,687	29,982	310,211
At furnace plants	12,976,293	1,167,767	298,124	14,442,184	858,681	87,116	35,901	981,698
Beehive plants:								
Alabama								
Colorado	278		2	280				
Kentucky	29,298			29,298				
Pennsylvania	6,381,891	106,604	21,846	6,510,341	39,952	19,156	527	59,635
Tennessee	10,438			10,438				
Utah	16,864		2,477	19,341	141			141
Virginia	293,391		226	293,617	750			750
West Virginia	423,764		42	423,806				
	7,155,924	106,604	24,593	7,287,121	40,843	19,156	527	60,526

DISTRIBUTION OF BYPRODUCT AND BEEHIVE COKE

The importance of metallurgical coke, the shortage of solid fuels for domestic requirements, and the problem of transportation in 1943 focused attention on coke production and distribution by uses and by geographic areas. Coke consumption by States, by uses, as shown in table 40, indicates the total quantity of coke available for consumption in each State, whether produced therein or received from other States, according to reports from producers. A comparison of the consumption by major uses, according to geographic areas, for 1941–43 is presented in table 41.

The total consumption of byproduct and beehive coke in the United States, exluding imports, amounted to 71,636,836 tons, a 2-percent increase over the previous high in 1942. The distribution of coke is widespread, and every State in the Union and the District of Columbia used coke in 1943. The total consumption of 4,962,594 tons of breeze, divided among 38 States and the District of Columbia, represented an increase of 7 percent over 1942.

Blast-furnace coke was used in 17 States in 1943, and the increased requirements by an expanded iron and steel industry resulted in a consumption of 57,629,884 tons, an increase of 4 percent over 1942. Byproduct and beehive coke used for producer-gas manufacture, water-gas manufacture, and other industrial purposes varied only slightly from the quantities so used in 1942. The quantity of coke available for domestic heating continued the downward trend started in 1940 because of diversion to the metallurgical industries and dropped 20 per cent from the 1942 total to but 4,714,960 tons. In spite of the curtailed supply of domestic coke, the quantity used by domestic consumers represented the second largest coke-consuming channel.

In New England the increase in blast-furnace coke consumption more than offset the decrease in use of foundry coke and resulted in a slight net increase in coke consumption for this area. In 1943 the expanded iron and steel industry, principally in Pennsylvania, accounted in large measure for the 2-percent increase over 1942 and 9-percent advance over 1941 in total coke consumption for the Middle Atlantic region.

Coke consumption increased in Ohio but decreased in Michigan compared with 1942. The increase in Ohio was due principally to the increased use of blast-furnace coke, whereas in Michigan the decrease was due to sharp curtailed supplies of domestic coke and a reduced consumption of blast-furnace coke.

In Illinois and Indiana blast-furnace-coke consumption increased in 1943, offset the decrease in other industrial uses, and resulted in a new high coke consumption of 12,160,807 tons. The Missouri Valley showed decreased consumption in 1943 chiefly because of curtailed domestic supplies. Total coke consumption in the Lake Dock region, in the Southeast region, and in the Southwest, Mountain, and Pacific region in 1943 all showed increases over 1942 mainly because of increased use of blast-furnace coke.

TABLE 40.—*Summary of byproduct and beehive coke and breeze consumed in each State in 1943, in net tons*

[Based upon reports from all United States producers showing destination of coke used by producer or sold in 1943. Does not include imported coke, which totaled 98,127 net tons in 1943]

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Alabama	4,620,892	117,304		504	156,651	72,610	4,967,961	312,846
Arizona		4,803			202		5,005	70
Arkansas		538		495	275	34	1,342	881
California	282,302	65,703			58,800		406,805	19,066
Colorado	646,578	16,306			26,317	287	689,488	63,353
Connecticut		40,501	86,734	89,443	9,714	204,897	431,289	47,012
Delaware		5,599			4,649	2,361	12,609	3,009
District of Columbia		425		53,533	15,937	182	70,077	80
Florida		3,733		37,894	6,348	2,915	50,890	3,989
Georgia		18,178		10,086	10,599	8,997	47,860	
Idaho		1,396			6,328		7,724	
Illinois	5,166,134	259,958	29,728	42,243	140,140	254,930	5,893,133	364,901
Indiana	5,806,096	121,098		47,028	175,898	117,554	6,267,674	460,451
Iowa		48,790		4,203	39,674	6,621	99,288	35,223

TABLE 40.—*Summary of byproduct and beehive coke and breeze consumed in each State in 1943, in net tons*—Continued

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Kansas	....	12,165	....	....	6,200	....	18,365	9,099
Kentucky	615,063	16,161	....	97,437	37,507	36,035	802,203	36,875
Louisiana	....	4,701	....	....	31,846	4,711	41,258	....
Maine	....	4,262	....	2,324	78	32,430	39,094	....
Maryland	2,386,998	29,472	....	35,479	25,823	1,326	2,479,098	132,477
Massachusetts	174,533	54,012	105,723	111,196	7,524	804,518	1,257,506	109,703
Michigan	1,214,729	293,838	10,462	3,915	367,690	400,807	2,291,441	206,073
Minnesota	487,271	34,631	4,875	5,398	37,990	328,456	898,621	62,665
Mississippi	....	3,698	....	....	1,157	990	5,845	....
Missouri	....	49,703	....	1,383	61,654	122,608	235,348	8,597
Montana	....	2,756	....	....	36,664	....	39,420	14,140
Nebraska	....	3,593	....	14,013	3,380	1,534	22,520	3,613
Nevada	....	41	....	....	5,484	....	5,525	(1)
New Hampshire	....	3,365	....	1,189	152	47,328	52,034	....
New Jersey	....	87,248	(1)	(1)	117,379	329,020	950,252	107,540
New Mexico	....	1,086	....	....	367	....	1,453	298
New York	3,940,836	156,613	319,137	803,357	353,924	969,057	6,542,924	423,103
North Carolina	....	10,936	....	3,938	3,712	2,692	21,278	30
North Dakota	....	119	....	184	295	1,623	2,221	....
Ohio	11,951,730	291,692	....	86,454	235,510	242,786	12,808,172	784,815
Oklahoma	....	4,407	....	....	222	....	4,629	17,431
Oregon	....	11,550	....	....	10,077	60	21,687	72
Pennsylvania	18,495,225	318,691	119,729	142,421	282,256	321,343	19,679,665	1,316,903
Rhode Island	....	10,331	(1)	(1)	(1)	159,913	207,999	(1)
South Carolina	....	4,466	....	2,314	6,904	3,355	17,039	7,440
South Dakota	....	(1)	....	....	(1)	1,641	2,001	....
Tennessee	231,824	103,353	....	4,737	94,080	5,124	439,118	108,883
Texas	....	24,017	....	2,112	40,865	248	67,242	36,420
Utah	242,512	11,429	....	....	49,074	1,733	304,748	17,926
Vermont	....	6,237	....	1,743	1,886	16,114	25,980	....
Virginia	60,003	43,439	....	335,366	75,144	2,701	516,653	5,297
Washington	....	18,342	....	698	12,098	13,678	44,816	9,944
West Virginia	1,307,158	45,066	....	887,025	172,942	3,939	2,416,130	110,654
Wisconsin	....	(1)	(1)	25,214	10,851	187,802	422,706	99,195
Wyoming	....	....	....	....	700	....	700	....
Undistributed	....	124,491	210,952	316,380	1,736	....	....	22,520
United States, total	57,629,884	2,490,243	887,340	3,169,706	2,744,703	4,714,960	71,636,836	4,962,594
Exported	60,276	116,646	....	3,153	194,982	170,568	545,625	97,486
Grand total	57,690,160	2,606,889	887,340	3,172,859	2,939,685	4,885,528	72,182,461	5,060,080

[1] Included under "Undistributed."

TABLE 41.—*Comparative tonnages of byproduct and beehive coke consumed in each State and region, 1941–43, in net tons*

[Exclusive of imported coke and of screenings or breeze]

Consuming region and State	Furnace use			Foundry use			Other industrial and domestic use			Total coke		
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
New England:												
Maine	----------	----------	----------	6, 485	5, 652	4, 262	55, 103	49, 777	34, 832	61, 588	55, 429	39, 094
New Hampshire	----------	----------	----------	4, 601	5, 169	3, 365	55, 465	51, 474	48, 669	60, 066	56, 643	52, 034
Vermont	----------	----------	----------	8, 141	8, 729	6, 237	26, 719	21, 606	19, 743	34, 860	30, 335	25, 980
Massachusetts	81, 666	144, 885	174, 533	63, 056	62, 359	54, 012	1, 055, 997	994, 825	1, 028, 961	1, 200, 719	1, 202, 069	1, 257, 506
Connecticut	----------	----------	----------	48, 562	51, 646	40, 501	350, 768	373, 098	390, 788	399, 330	424, 744	431, 289
Rhode Island	----------	----------	----------	15, 613	19, 112	10, 331	178, 403	172, 506	197, 668	194, 016	191, 618	207, 999
	81, 666	144, 885	174, 533	146, 458	152, 667	118, 708	1, 722, 455	1, 663, 286	1, 720, 661	1, 950, 579	1, 960, 838	2, 013, 902
Middle Atlantic:												
New York	3, 395, 181	3, 827, 457	3, 940, 836	201, 752	188, 207	156, 613	2, 595, 437	2, 431, 943	2, 445, 475	6, 192, 370	6, 447, 607	6, 542, 924
New Jersey	----------	----------	----------	122, 896	130, 799	87, 248	893, 233	908, 196	863, 004	1, 016, 129	1, 038, 995	950, 252
Pennsylvania	16, 663, 593	17, 855, 365	18, 495, 225	331, 451	311, 934	318, 691	872, 523	1, 014, 547	865, 749	17, 867, 567	19, 181, 846	19, 679, 665
Delaware	----------	----------	----------	4, 227	6, 142	5, 599	9, 271	7, 497	7, 010	13, 498	13, 639	12, 609
Maryland	1, 920, 995	2, 220, 653	2, 386, 998	36, 550	25, 746	29, 472	85, 284	76, 679	62, 628	2, 042, 829	2, 323, 078	2, 479, 098
District of Columbia	----------	----------	----------	183	----------	425	62, 152	66, 811	69, 652	62, 335	66, 811	70, 077
	21, 979, 769	23, 903, 475	24, 823, 059	697, 059	662, 828	598, 048	4, 517, 900	4, 505, 673	4, 313, 518	27, 194, 728	29, 071, 976	29, 734, 625
Ohio	11, 005, 454	11, 685, 420	11, 951, 730	307, 127	339, 946	291, 692	628, 719	503, 896	564, 750	11, 941, 300	12, 529, 262	12, 808, 172
Michigan	1, 058, 522	1, 397, 755	1, 214, 729	415, 126	278, 501	293, 838	1, 034, 768	1, 146, 053	782, 874	2, 508, 416	2, 822, 309	2, 291, 441
Illinois-Indiana:												
Illinois	4, 369, 826	4, 712, 040	5, 166, 134	241, 538	232, 638	259, 958	790, 831	677, 513	467, 041	5, 402, 195	5, 622, 191	5, 893, 133
Indiana	5, 231, 850	5, 562, 396	5, 806, 096	145, 936	113, 748	121, 098	434, 610	375, 104	340, 480	5, 812, 396	6, 051, 248	6, 267, 674
	9, 601, 676	10, 274, 436	10, 972, 230	387, 474	346, 386	381, 056	1, 225, 441	1, 052, 617	807, 521	11, 214, 591	11, 673, 439	12, 160, 807
Missouri Valley:												
Missouri	----------	----------	----------	51, 836	51, 410	49, 703	209, 391	214, 663	185, 645	261, 227	266, 073	235, 348
Iowa	----------	----------	----------	52, 074	42, 138	48, 790	44, 078	51, 592	50, 498	96, 152	93, 730	99, 288
Nebraska	----------	----------	----------	5, 987	2, 567	3, 593	23, 308	21, 366	18, 927	29, 295	23, 933	22, 520
Kansas	----------	----------	----------	10, 690	10, 127	12, 165	3, 467	4, 258	6, 200	14, 157	14, 385	18, 365
	----------	----------	----------	120, 587	106, 242	114, 251	280, 244	291, 879	261, 270	400, 831	398, 121	375, 521

TABLE 41.—*Comparable tonnages of byproduct and beehive coke consumed in each State and region, 1941–43, in net tons*—Continued

[Exclusive of imposted coke and of screenings or breeze]

Consuming region and State	Furnace use			Foundry use			Other industrial and domestic use			Total coke		
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
Lake Dock:												
Wisconsin				139,350	120,400	(1)	491,578	455,467	(1)	630,928	575,867	422,706
Minnesota	282,693	292,910	487,271	24,764	27,981	34,631	333,202	361,826	876,719	640,659	682,717	898,621
North Dakota				61	57	119	1,596	1,960	2,102	1,657	2,017	2,221
South Dakota				250	212	(1)	2,616	2,088	(1)	2,866	2,300	2,001
	282,693	292,910	487,271	164,425	148,650	159,241	828,992	821,341	679,037	1,276,110	1,262,901	1,325,549
Southeast:												
Virginia	74,491	75,648	60,003	46,514	48,043	43,439	443,298	449,821	413,211	564,303	573,512	516,653
West Virginia	874,483	1,281,959	1,307,158	25,678	31,739	45,066	546,166	886,120	1,063,906	1,446,327	2,199,818	2,416,130
North Carolina				15,406	17,298	10,936	10,417	10,622	10,342	25,823	27,920	21,278
South Carolina				4,397	5,265	4,466	6,385	26,500	12,573	10,782	31,765	17,039
Georgia				19,147	19,289	18,178	27,864	28,147	29,682	47,011	47,436	47,860
Florida				1,641	2,410	3,733	35,166	45,237	47,157	36,807	47,647	50,890
Kentucky	281,364	400,108	615,063	21,897	21,153	16,161	59,549	113,876	170,979	362,810	535,137	802,203
Tennessee	140,162	224,623	231,824	76,177	72,203	103,353	76,124	142,480	103,941	292,463	439,306	439,118
Alabama	4,140,855	4,826,996	4,620,892	164,668	167,189	117,304	135,433	239,461	229,765	4,440,956	5,233,646	4,967,961
Mississippi				1,060	845	3,698	2,590	3,197	2,147	3,650	4,042	5,845
	5,511,355	6,809,334	6,834,940	376,585	385,434	366,334	1,342,992	1,945,461	2,083,703	7,230,932	9,140,229	9,284,977
Southwest, Mountain, and Pacific:												
Louisiana				3,785	3,811	4,701	29,702	31,024	36,557	33,487	34,835	41,258
Arkansas				1,258	759	538	564	900	804	1,822	1,659	1,342
Oklahoma				3,476	4,064	4,407	444	1,116	222	3,920	5,180	4,629
Texas				24,471	24,210	24,017	36,840	35,414	43,225	61,311	59,624	67,242
New Mexico				1,259	1,664	1,086	360	264	367	1,619	1,928	1,453
Arizona				6,500	5,925	4,803	387	455	202	6,887	6,380	5,005
Colorado	573,925	648,734	646,578	21,969	17,089	16,306	20,246	31,556	26,604	616,140	697,379	689,488
Utah	171,304	155,530	242,512	18,074	15,288	11,429	53,421	64,770	50,807	242,799	235,588	304,748
Nevada				56	30	41	6,857	8,216	5,484	6,913	8,246	5,525
Wyoming				811			7,138	2,174	700	7,949	2,174	700
Montana				2,515	3,120	2,756	29,188	39,823	36,664	31,703	42,943	39,420
Idaho				2,873	633	1,396	2,640	3,494	6,328	5,513	4,127	7,724
Washington				8,111	8,260	18,342	3,469	4,355	26,474	11,580	12,615	44,816
Oregon				4,871	7,784	11,550	5,056	5,314	10,137	9,927	13,098	21,687
California			282,302	72,657	62,677	65,703	44,743	62,969	58,800	117,400	125,646	406,805
	745,229	804,264	1,171,392	172,686	155,314	167,075	241,055	291,844	303,375	1,158,970	1,251,422	1,641,842

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[1] Bureau of Mines not at liberty to publish data.

EXPORTS AND IMPORTS [8]

Exports.—According to figures compiled by the Bureau of Mines from records of the United States Department of Commerce, the exports of coke from the United States in 1943 increased 18 percent over 1942 and totaled 994,607 tons. This was the highest tonnage of coke shipped outside continental United States since 1934. The increase in exports was due to shortages of metallurgical and domestic solid fuels in Canada in 1943 and to the demand for United States coke to augment the supply. Of the 994,607 tons of coke exported, Canada received 97 percent, most of which moved through the gateways of Buffalo and Michigan. Apart from Canada, the export movement of coke was small, although 9,714 tons were shipped to Brazil, and 6,466 tons to Mexico.

TABLE 42.—*Coke exported from the United States, 1941–43, by countries and customs districts*

	1941		1942		1943	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
North America:						
Canada	630,271	$4,390,888	806,517	$5,925,858	962,489	$6,865,179
Mexico	5,167	42,344	2,032	23,497	6,466	52,426
Panama	267	6,604	111	2,403	6	74
West Indies:						
Cuba	9,458	96,992	11,760	123,516	2,893	37,916
Trinidad and Tobago	102	1,183			73	859
Other North America	882	16,833	475	9,298	769	22,618
South America:						
Argentina	23,164	325.888	5,048	79,087	4,988	88.861
Bolivia	399	7,401	200	3,349	296	7,291
Brazil	16,122	185,483	4.742	81,314	9,714	148,575
Chile	13,811	174,565	7,417	75,719	5,090	80,320
Peru	222	4,020	398	10,337	903	19,928
Other South America	867	16,470	661	10,474	670	14,691
Europe:						
Azores	156	2,464			250	3,750
Portugal	10	280				
Asia:						
Japan	3,471	60,262				
Philippine Islands	4,092	51,359				
Oceania	10	290				
Africa	500	5,979	221	4.949		
	708.971	5.389,305	839.582	6.349.801	994.607	7.342,488
CUSTOMS DISTRICT						
Buffalo	225.119	1,461,672	280.085	1,995.909	500,418	3,328,111
Chicago	24.714	194,536	6,395	18.558		
Dakota	7,007	63.437	18.472	158.673	27,722	223,400
Duluth-Superior	3,414	34.588	9,296	86.835	11,221	90,127
Florida	3.504	40.201	4,487	56.119	5,551	78,268
Laredo	3.888	33.920	1,335	13,962	1,014	9,093
Maryland	16,085	167,751	2,926	27,134	2,285	27,875
Michigan	315,363	2,374,350	417,608	3,300.445	324,258	2,600,182
Mobile	5,329	82.021	7,135	66.957	3.733	34,131
New Orleans	4.805	52,390	3,937	59,880	9,351	173,754
New York	20.675	326,492	5.704	111,585	3,876	90,537
Ohio	42,951	160,182	70,819	331,769	52,258	229,051
Philadelphia	13,020	162,590			459	9,891
St. Lawrence	4,368	45,252	3,506	30,977	15,840	116,419
San Diego	1,146	6,748	503	7,176	546	6,052
San Francisco	10	290	6	167	189	6,525
Virginia	10,070	122,714	6.767	75,164	195	2,494
Other districts	7,503	60,171	601	8,491	35,691	316.578
	708.971	5,389.305	839,582	6,349,801	994.607	7.342,488

Imports.—Coke imports decreased 10 percent in 1943 and totaled 98,127 tons. Canada and Great Britain were the only sources from which coke was imported in 1943. Canada supplied nearly all coke imported, as the quantity furnished by Great Britain amounted to less than 1 percent.

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[8] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 43.—*Coke imported for consumption in the United States, 1941–43, by countries and customs districts*

	1941		1942		1943	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
Canada	89,677	$1,251,417	97,709	$1,223,170	97,654	$1,107,499
Mexico	---	---	7,291	84,579	---	---
United Kingdom [1]	178,209	940,512	3,819	34,449	473	5,364
	267,886	2,191,929	108,819	1,342,198	98,127	1,112,863
CUSTOMS DISTRICT						
Buffalo	48,143	1,023,849	51,732	972,013	51,562	838,224
Connecticut	3,793	27,880	---	---	---	---
El Paso	---	---	6,674	79,919	---	---
Florida	---	---	---	---	473	5,364
Laredo	---	---	617	4,660	---	---
Los Angeles	1,690	11,870	---	---	---	---
Maine and New Hampshire	342	2,849	85	713	534	4,837
Maryland	107,169	579,442	---	---	---	---
Massachusetts	60,062	289,517	---	---	---	---
Michigan	9	76	---	---	---	---
Montana and Idaho	37,339	201,793	38,877	218,241	31,798	192,626
New York	3,351	16,752	3,819	34,449	---	---
St. Lawrence	---	---	---	---	37	498
San Francisco	2,143	15,051	---	---	---	---
Vermont	360	2,977	---	---	573	7,498
Washington State	3,485	19,873	7,015	32,203	13,150	63,816
	267,886	2,191,929	108,819	1,342,198	98,127	1,112,863

[1] United Kingdom of Great Britain and Northern Ireland.

WORLD PRODUCTION

Data on production of coke have not been available for many of the principal coke-producing countries since or immediately before the outbreak of World War II. The output of coke in Canada has increased steadily in recent years and reached a new high of 2,722,301 metric tons in 1943, a gain of 7 percent over 1942. Production in the United States in 1943 soared to a new all-time high record and totaled 65,023,091 metric tons. The figures presented in table 44 show that, in 1938, Axis nations or countries now occupied by the Axis Powers produced about 50 percent of the total world output of coke; more recent complete data are not now available.

TABLE 44.—*Coke produced in principal countries of the world, 1929, 1938, and 1940–43, in metric tons* [1] [2]

[Compiled by B. B. Waldbauer]

Country [2]	1929	1938	1940	1941	1942	1943
Australia:						
New South Wales	471,813	1,153,670	(3)	(3)	(3)	(3)
Queensland	4,144	31,481	(3)	(3)	(3)	(3)
Belgium	6,192,960	4,894,980	(3)	(3)	(3)	(3)
Brazil	-------	-------	9,912	21,068	10,267	19,845
Bulgaria	-------	3,923	6,000	(3)	(3)	(3)
Canada	1,986,532	1,808,588	2,321,775	2,431,942	2,536,165	2,722,301
China (exports)	13,467	11,630	18,456	[4] 11,918	(3)	(3)
Czechoslovakia	3,170,629	[5] 2,367,000	(3)	(3)	(3)	(3)
France	9,080,127	7,785,000	(3)	(3)	(3)	(3)
Germany	39,421,033	43,511,082	(3)	(3)	(3)	(3)
Saar	2,423,000					
Great Britain [6]	13,637,421	13,031,396	(3)	(3)	(3)	(3)
Hungary	2,092	53,092	(3)	(3)	(3)	(3)
India, British [7]	843,504	1,738,178	(3)	(3)	(3)	(3)
Indochina	637	3,503	2,608	(3)	(3)	(3)
Italy	791,607	1,739,417	(3)	(3)	(3)	(3)
Mexico	493,777	(3)	(3)	(3)	(3)	(3)
Netherlands	2,402,566	3,158,065	(3)	(3)	(3)	(3)
New Caledonia	-------	49,875	69,762	99,700	83,661	(3)
Peru	35,899	-------	(3)	(3)	(3)	(3)
Poland	1,858,052	2,523,290	(3)	(3)	(3)	(3)
Rhodesia, Southern	100,001	47,986	[8] 60,238	[8] 68,556	[8] 75,765	[8] 68,658
Rumania	-------	86,030	(3)	(3)	(3)	80,000
Spain	768,040	571,469	839,744	753,108	840,000	(3)
Sweden	103,778	112,107	(3)	(3)	(3)	(3)
Turkey	-------	84,930	60,192	58,642	(3)	(3)
Union of South Africa	99,297	163,315	(3)	(3)	(3)	(3)
U. S. S. R	4,700,000	20,700,000	16,500,000	(3)	(3)	(3)
United States	54,325,427	29,479,553	51,774,699	59,135,960	64,018,735	65,023,091
	142,926,000	[9] 135,110,000	(3)	(3)	(3)	(3)

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[1] Gas-house coke is not included.

[2] In addition to countries listed coke is produced in Chosen and Japan, but data of production are not available.

[3] Data not available.

[4] January to August, inclusive.

[5] Excluding Sudentenland since October.

[6] In Great Britain the production of gas-house coke (including breeze), not included above, is especially important and was 13,049,139 tons in 1938.

[7] Figures for 1929 represent "hard" and "soft" coke made at collieries only—73,616 tons of "hard" coke and 769,888 tons of "soft" coke. Data for other years shown represent total "hard" coke manufactured. In addition, in 1938, 921,479 tons of "soft" coke were made at collieries.

[8] Sales of coke by Wankie colliery for year ended August 30 of year stated.

[9] Exclusive of Mexico.

GAS-HOUSE COKE

The output of gas-house coke in the United States in 1943 totaled 862,104 tons, valued at $6,745,791. The output in 1943 was 3 percent less than in 1942 and comprised 364,745 tons from horizontal retorts and 497,359 tons from vertical retorts, semi-inclined retorts, and miniature gas ovens. In 1943, gas-house coke was produced at 95 plants located in 27 States. The quantity of bituminous coal used in the manufacture of gas-house coke decreased 6 percent when compared with 1942 and totaled 1,436,216 tons valued at $8,882,543.

Data on the disposition of gas-house coke by producers in 1943 showed 394,937 tons were used at producing plants—51 percent for bench fuel, 38 percent for the manufacture of water gas, 4 percent for the manufacture of producer gas, and 7 percent for miscellaneous purposes.

Total sales of gas-house coke in 1943 amounted to 577,931 tons—90 percent for domestic heating, 5 percent for the manufacture of water gas, and 5 percent for miscellaneous industrial uses. Ordinarily about half of the annual gas-house coke production is sold for domestic heating, but the shortages of other solid fuels in 1943 resulted in an increase in sales to domestic consumers from 50 percent of the output in 1942 to 60 percent. Summaries of coal-gas operations, exclusive of gas production, are shown in tables 45 and 46.

TABLE 45.—*Salient statistics of the coal-gas industry in the United States in 1943*

	Horizontal retorts	Vertical retorts and gas ovens	Total
Coke produced:			
Quantity net tons	364, 745	497, 359	862, 104
Value	$2, 673, 644	$4, 072, 147	$6, 745, 791
Screenings or breeze produced:			
Quantity net tons	30, 952	92, 240	123, 192
Coal charged into retorts:			
Quantity do	588, 727	847, 489	1, 436, 216
Value	$3, 658, 454	$5, 224, 089	$8, 882, 543
Average per ton	$6. 21	$6. 16	$6. 18
Average yield in percent of coal charged:[1]			
Coke	60. 78	57. 70	60. 03
Breeze	7. 73	12. 59	10. 87
Retorts:			
In existence December 31	2, 318	[2] 719	3, 037
In operation December 31	1, 800	[3] 691	2, 491
Annual coal capacity net tons	909, 233	1, 054, 923	1, 964, 156
Coke used by producer:			
To make water gas:			
Quantity do	48, 211	103, 429	151, 640
Value	$316, 354	$880, 381	$1, 196, 735
To make producer gas:			
Quantity net tons	540	14, 654	15, 194
Value	$3, 509	$77, 994	$81, 503
For bench fuel:			
Quantity net tons	102, 709	97, 861	200, 570
Value	$686, 159	$797, 832	$1, 483, 991
For other purposes:			
Quantity net tons	17, 714	9, 819	27, 533
Value	$110, 952	$66, 637	$177, 589
Coke sold to other consumers:			
For manufacture of water gas:			
Quantity net tons	7, 013	19, 904	26, 917
Value	$49, 972	$156, 579	$206, 551
For domestic use:			
Quantity net tons	219, 911	298, 914	518, 825
Value	$1, 757, 158	$2, 499, 769	$4, 256, 927
For other industrial use:			
Quantity net tons	14, 641	17, 548	32, 189
Value	$106, 930	$136, 992	$243, 922
Stocks on hand January 1, 1944:			
Coke net tons	17, 274	26, 032	43, 306
Breeze do	4, 182	20, 940	25, 122
Byproducts obtained:			
Coal tar:			
Production gallons	7, 440, 736	12, 408, 132	19, 848, 868
Sales do	6, 782, 562	11, 837, 988	18, 620, 550
Value	$306, 325	$595, 153	$901, 478
Stocks on January 1, 1944 gallons	2, 836, 503	2, 034, 436	4, 870, 939
Per ton of coal charged do	12. 64	14. 64	13. 82
Ammonia liquor (NH_3 content):			
Production pounds	60, 773	1, 281, 123	1, 341, 896
Sales do	56, 570	1, 265, 405	1, 321, 975
Value	$4, 073	$38, 814	$42, 887
Stocks on January 1, 1944 pounds	11, 872	135, 476	147, 348
Per ton of coal charged do	1. 02	3. 33	3. 02
Crude light oil:			
Production gallons	29, 317	63, 717	93, 034
Sales do	23, 659	74, 891	98, 550
Value	$1, 440	$5, 358	$6, 798
Stocks on January 1, 1944 gallons	19, 504	9, 880	29, 384
Per ton of coal charged do	0. 86	0. 44	0. 53
Other byproducts:[4]			
Value	$631	$2, 692	$3, 323

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[1] Calculated on coal charged at plants actually recovering.
[2] Includes 37 gas ovens.
[3] Includes 15 gas ovens.
[4] Comprised of drip and holder oil and retort carbon.

TABLE 46.—*Number of retorts, coal charged, coke produced, value, and stocks at coal-gas plants in the United States in 1943, by States*

State	Active plants	Retorts		Coal capacity per 24-hour day (net tons)	Coal charged (net tons)	Yield of coke from coal (per cent)	Coke			
		In existence	In operation end of year				Produced (net tons)	Value		On hand December 31, 1943 (net tons)
								Total	Average	
Alabama and Kentucky	3	42	36	32.0	7,588	53.76	4,079	$19,478	$4.78	232
Colorado and North Dakota	4	72	53	116.9	20,480	59.16	12,116	104,566	8.63	1,288
Connecticut, Maine, Rhode Island, and Vermont	6	[1] 119	[1] 95	431.8	134,240	58.56	78,609	659,446	8.39	5,123
Georgia	3	60	48	55.6	12,609	56.23	7,090	41,959	5.92	115
Illinois, Indiana, and Iowa	4	63	51	98.1	30,585	64.58	19,752	183,258	9.28	352
Maryland, Virginia, and West Virginia	4	107	56	174.6	43,974	64.52	28,373	189,692	6.69	559
Massachusetts	10	440	399	1,292.8	400,351	56.69	226,952	1,955,217	8.62	18,461
Michigan	18	[2] 376	269	428.6	90,894	66.18	60,151	435,635	7.24	3,067
Minnesota	4	102	78	102.0	19,788	60.65	12,001	114,843	9.57	45
New Jersey, New York, and Ohio	6	302	272	456.2	126,904	65.89	83,614	648,693	7.76	7,257
North Carolina	10	306	300	408.5	87,845	59.60	52,360	312,024	5.96	1,271
Pennsylvania	5	165	144	293.8	87,611	65.12	57,053	530,372	9.30	525
South Carolina	3	126	114	175.6	40,919	64.72	26,482	154,638	5.84	2,013
Tennessee	3	270	153	267.6	63,240	62.19	39,328	228,226	5.80	38
Washington	3	156	156	103.4	31,057	59.96	18,622	146,004	7.84	502
Wisconsin	9	331	267	943.8	238,131	56.91	135,522	1,021,740	7.54	2,458
	95	[3] 3,037	[1] 2,491	5,381.3	1,436,216	60.03	862,104	6,745,791	7.82	43,306

[1] Includes 15 horizontal gas ovens. [2] Includes 22 horizontal gas ovens. [3] Includes 37 horizontal gas ovens

COKE-OVEN BYPRODUCTS

SUMMARY OF BYPRODUCTS

Byproduct-coke ovens are sources of vital raw materials for many industries, including chemical, dyestuff, explosive, fertilizer, paint, pharmaceutical, plastic, petroleum, synthetic rubber, and wood preserving. The increased military and civilian requirements for the various coal byproducts stimulated recovery in 1943, and several coke plants installed additional facilities for processing crude tar and crude light oil. In addition to their importance to our national economy in times of peace and in war, the recovery of coke byproducts is both an economical and a conservational measure. For example, the value of the byproducts recovered at producing plants is estimated at more than $241,000,000; of these byproducts recovered, breeze, gas, tar, and light oil had a calorific value equivalent to 21,553,000 net tons of coal, which would have been lost had the coke been made in beehive ovens (table 48). The statistics in the following tables are confined to five general groups, some of which are further subdivided. They are: (1) Gas, the most valuable, (2) crude tar and its derivatives, (3) ammonium sulfate and ammonia liquor, (4) crude light oil and its derivatives, and (5) miscellaneous byproducts. Although the quantity of coal charged into byproduct ovens in 1943 was the highest ever recorded, the quantity of crude tar and ammonia fell short of the previous record attained in 1942, mainly because the oven operations were directed toward maximum output of coke, and high oven temperatures and shorter coking periods reduced the yields of these two products per ton of coal charged. The output of gas and crude light oil surpassed the previous record output in 1942 and attained new high levels of 960,454,518 M cubic feet and 250,511,095 gallons, increases of 2 percent each over 1942.

The total sales value of all byproduct sold (excluding the value of tar used by producers and of the breeze produced) increased 3 percent over the 1942 figure to $181,929,705 and amounted to 43 percent of the value of the byproduct coke produced.

Gas.—Other than coke, gas is the most important product of coal carbonization, if judged either by value or by heat content. Gas contributed approximately 50 percent of the total revenue derived from the sales of all byproducts in 1943, and the surplus gas sold or used had a calorific value equivalent to 12,427,000 tons of coal. Byproduct-coke ovens are by far the largest producers of manufactured gas in the United States and are an important factor in the distribution of gas and power to affiliated and neighboring industries, public utilities, and communities. The quantity of surplus gas used or sold for industrial purposes and distributed through city mains amounted to 62 percent of the output and was valued at $88,620,185. In 1943 quantities of coke-oven gas used for heating ovens increased 2 percent and that wasted 16 percent over 1942; however, the proportions of the total output used for heating ovens and wasted remained the same as in 1942 (36 percent and 2 percent). The average unit value of the surplus gas dropped slightly from $0.152 per M cubic feet in 1942 to $0.150.

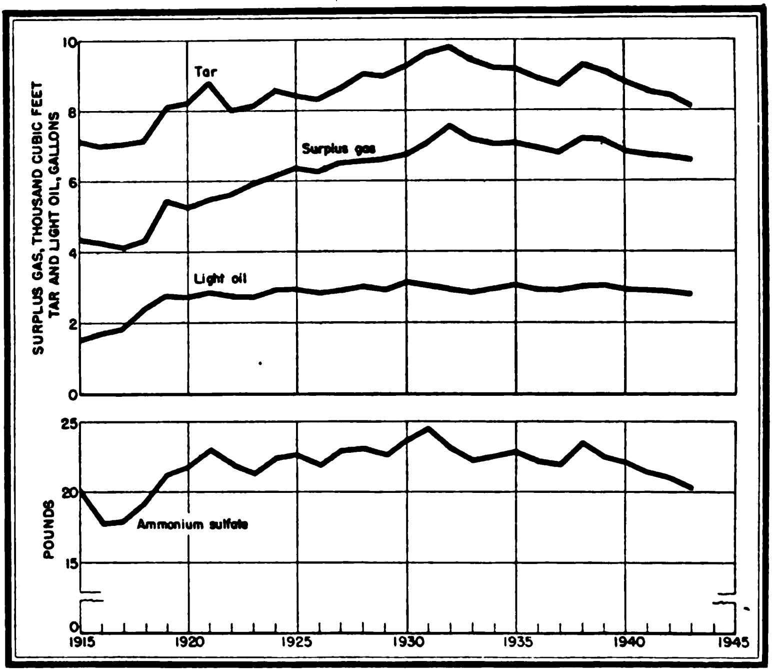

FIGURE 2.—Average yield of principal byproducts per net ton of coal carbonized in byproduct-coke ovens, 1915–43. Figures for light oil represent average at plants recovering light oil.

Crude coal tar and tar derivatives.—In recent years considerable interest has been directed toward the more efficient utilization of tar for recovering its valuable byproducts. The impetus of wartime requirements for tar acids, phenol, cresols, pyridine, naphthalene, and other products—all essential to military and civilian needs—resulted in some interesting developments in 1943. The need for tar acid oils by the expanded war industries resulted in the issuance by the War Production Board of Conservation Order M–297 on March 30, 1943, effective on and after May 1, 1943, which restricted the use of crude tar as fuel and the use of tar-acid oils. Under this order, only coal tar which had a low-boiling tar-acid content of less than 0.5 percent could be burned, and no distiller could use coal-tar oil produced on or after May 1 except for extracton of tar acids; moreover, the producers or distillers, could not deliver such coal-tar oil to any person other than distillers unless the coal-tar acids had a low-boiling tar-acid content of less than 1.5 percent. Some exceptions were later granted to a few coke plants where a satisfactory substitute fuel oil could not be obtained. In 1943 ceiling prices were established for crude coal tar through issuance of Maximum Price Regulation 447 on August 14, 1943, effective August 20, 1943, by the Office of Price Administration and Amendment 1 issued November 16, 1943, effective November 22, 1943.

The quantity of crude tar processed (topped or refined) by coke-oven operators in 1943 increased 5 percent over 1942 and was equivalent to 28 percent of the total output. The volume of crude tar sold by producers to other purchasers for refining decreased slightly in the same period and amounted to 57 percent of the total production. The increase in open-hearth operations and the scarcity of fuel oil during 1943 resulted in a 4-percent increase in the quantity of crude tar sold and used for fuel purposes. The average unit value of the crude tar sold was the same as 1942—$0.054 per gallon.

The production of creosote, the most valuable derivative obtained in tar distillation, totaled 43,552,772 gallons, and the value of sales amounted to $5,180,653.

The quantity of tar-acid oil produced at byproduct plants totaled 15,165,320 gallons, exclusive of production of tar-acid oil at plants which further refined it for recovery of phenols. The heavy tars and pitches obtained as a residue from the distillation of crude tar constitutes 50 to 80 percent of the original tar. In 1943 the quantity of pitch of tar recovered increased slightly and totaled 667,254 tons—369,015 tons of soft pitch and 298,239 tons of hard. The marketing of pitch produced at byproduct-coke plants has not been developed extensively, and in 1943 approximately 96 percent of the total output was used by the producers as fuel.

Data on production of other tar derivatives, among which are phenol, cresols, cresylic acid, road tar, and other miscellaneous derivatives, cannot be shown without disclosing individual plant operations, and only their total sales value is given.

Ammonia.—The output of ammonia (NH_3 equivalent of all forms) totaled 448,846,502 pounds in 1943, a decrease of 2,409,928 pounds from the previous peak record in 1942. Approximately 85 percent of the ammonia produced at byproduct-coke plants in 1943 was converted into sulfate; the remainder was recovered as ammonia liquor. The relatively low conversion costs and the large demands for sulfate by the fertilizer industry explain the fact that most of the ammonia produced was converted into ammonium sulfate. Production of ammonium sulfate decreased 11,068,274 pounds, but ammonia liquor (NH_3 content) increased 357,140 pounds in 1943 when compared with 1942; however, sales of both sulfate and ammonia liquor increased and resulted in a gain of 3 percent for sulfate and 1 percent for ammonia liquor.

The average unit value of ammonium sulfate in 1943 remained the same as for the previous year at $0.013 per pound; the value of ammonia liquor increased slightly and averaged $0.037 per pound.

Light oil and its derivatives.—In 1943 the production of crude light oil amounted to 250,511,095 gallons, a 2-percent increase over the previous high of 1942 Of the total output 98 percent was refined by the producers and but 2 percent was sold to other purchasers. Benzol comprises approximately 63 percent of the crude light oil, and in 1943 the combined output of all grades of benzol amounted to 153,707,106 gallons, an increase of 2 percent over 1942. The quantities of 1° and 2° benzol produced increased markedly in the same period, mainly because of the large demands of these two grades for use in the manufacture of synthetic rubber (styrene) and aviation gasoline (cumene), whereas the production of motor benzol decreased 67 percent because of restrictions on the use of benzol in motor fuel (fig. 3). The production of crude and refined toluol varied slightly from the production of the previous year and totaled 32,272,593 gallons. Nearly 86 percent of all toluol produced was 1° or nitration grade and was sold almost exclusively for the manufacture of high explosives. The output of xylol, solvent naphtha, and other light-oil products in 1943 was 8,763,927, 5,232,848, and 8,955,610 gallons, respectively, compared with 9,332,273, 5,215,617, and 9,238,117 gallons in 1942. Benzol, toluol, and xylol were under allocation the entire year, and the various allocation orders are listed under Gov-

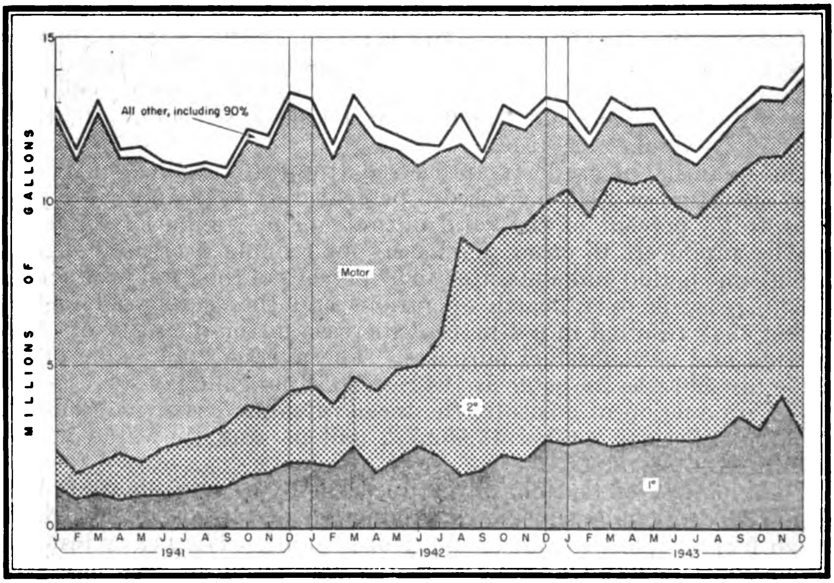

FIGURE 3.—Quantity of benzol produced at byproduct-coke plants in the United States, by grades, 1941-43.

ernment Control Measures. The average unit values of the various light-oil derivatives were approximately the same as in 1942 at $0.09 per gallon for motor benzol, $0.13 for all other grades of benzol except motor, $0.269 per gallon for toluol, $0.249 per gallon for xylol, $0.148 per gallon for solvent naphtha, and $0.10 per gallon for all other products. Ceiling prices on benzol, toluol, and xylol were under the jurisdiction of the Office of Price Administration.

TABLE 47.—*Byproducts obtained from coke-oven operations in the United States in 1943*[1]

[Exclusive of screenings or breeze]

Product	Production	Sales			On hand December 31
		Quantity	Value		
			Total	Average	
Tar..........gallons..	738, 166, 968	455, 638, 846	$24, 569, 762	$0. 054	37, 146, 107
Ammonia:					
Sulfate..........pounds..	1, 522, 539, 911	1, 549, 629, 066	20, 211, 666	. 013	56, 794, 743
Liquor (NH_3 content)..........do....	68, 211, 524	64, 654, 062	2, 407, 450	. 037	1, 982, 763
	....	....	22, 619, 116	......	....
Sulfate equivalent of all forms..........do....	1, 795, 386, 007	1, 808, 245, 314	....	......	64, 725, 795
NH_3 equivalent of all forms..........do....	448, 846, 502	452, 061, 329	....	......	16, 181, 449
Gas:					
Used under boilers, etc..........M cubic feet..	[2] 960, 454, 518	39, 870, 361	3, 049, 567	. 076	....
Used in steel or affiliated plants..........do....		345, 418, 565	35, 683, 766	. 103	....
Distributed through city mains..........do....		169, 788, 941	44, 594, 210	. 263	....
Sold for industrial use..........do....		37, 197, 507	5, 292, 642	. 142	....
	[2] 960, 454, 518	592, 275, 374	88, 620, 185	. 150	....
Light oil and derivatives:					
Crude light oil..........gallons..	[3] 250, 511, 095	17, 195, 002	1, 541, 698	. 090	3, 948, 929
Benzol, all grades except motor..........do....	132, 439, 174	131, 345, 032	17, 131, 372	. 130	3, 864, 744
Motor benzol..........do....	21, 267, 932	21, 387, 487	1, 925, 569	. 090	1, 051, 423
Toluol, crude and refined..........do....	32, 272, 593	31, 823, 080	8, 566, 565	. 269	906, 946
Xylol..........do....	8, 763, 927	8, 634, 391	2, 148, 911	. 249	499, 027
Solvent naphtha..........do....	5, 232, 848	4, 878, 296	719, 669	. 148	415, 290
Other light-oil products..........do....	8, 955, 610	6, 555, 340	652, 370	. 100	212, 175
	[4] 208, 932, 084	221, 818, 628	32, 686, 154	. 147	....
Naphthalene, crude..........pounds..	98, 096, 899	98, 031, 058	2, 088, 829	. 021	2, 760, 267
Tar derivatives:					
Creosote oil, distillate as such..........gallons..	31, 701, 675	31, 706, 196	4, 087, 042	. 129	581, 046
Creosote oil in coal-tar solution..........do....	11, 851, 097	8, 914, 394	1, 093, 611	. 123	825, 596
Tar acid oil..........do....	15, 165, 320	15, 160, 304	1, 990, 232	. 131	468, 813
Pitch of tar:					
Soft [5]..........net tons..	369, 015	20, 526	350, 789	17. 090	23, 713
Hard [6]..........do....	298, 239	10, 880	68, 316	6. 279	1, 097
Other tar derivatives..........	....	....	2, 132, 545	......	....
Carbolic oil, light and heavy..........gallons..	1, 575, 925	1, 652, 128	200, 407	. 121	70, 562
Pyridine:					
Crude..........do....	475, 027	388, 509	300, 283	. 773	70, 539
Refined..........do....	111, 390	111, 714	392, 121	3. 510	4, 346
Sodium phenolate..........do....	3, 376, 343	3, 420, 819	157, 614	. 046	62, 328
Other byproducts [7]..........	....	....	572, 699	......	....
Value of all byproducts sold..........	....	....	[8] 181, 929, 705	......	....

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name.
[2] Includes gas wasted and gas used for heating ovens.
[3] Refined on premises to make the derived products shown: **245,893,002 gallons.**
[4] Total gallons of derived products.
[5] Softening point less than 110° F.
[6] Softening point over 160° F. Includes some medium pitch of tar reported by one producer.
[7] Ammonium thiocyanate, cyanogen sludge, dicyclopentadiene, phenol from sources other than tar distillation, picoline, residuals, sodium cyanide, sodium prussiate, sulfur, and vented vapors.
[8] Exclusive of value of breeze production, which was $12,206,564 in 1943.

Naphthalene.—Increased war demands for naphthalene stimulated production, and output of crude naphthalene at byproduct-coke plants in 1943 increased 3 percent over 1942. Crude naphthalene at byproduct-coke plants is recovered from refining either light oil or tar. About 50 percent of the crude naphthalene produced at byproduct-coke plants, mainly from light-oil refining, is sold to large tar refineries for further processing. Most of the naphthalene recovered from coal-tar distillation is sold for consumption as such and is not refined further. The quantity of crude naphthalene sold in 1943 increased 3 percent over 1942 and totaled 98,031,058 pounds; however, the value of that sold increased 8 percent and totaled $2,088,829. Naphthalene remained under allocation in 1943.

Miscellaneous byproducts.—The increased demands and the stimulus of higher prices resulted in substantial production of miscellaneous byproducts. When compared with the major byproducts in terms of quantity and value they are small; nevertheless, they are a significant item in coking operations. The salvage of phenol from ammonia-still wastes has increased steadily; pyridine production in recent years has increased markedly; the recovery of sulfur from coke-oven gas is being more widely practiced; and all of the foregoing have assumed an importance in the war economy.

TABLE 48.—*Coal equivalent of byproducts of byproduct coking in the United States, 1913, 1914, 1918, and 1942–43*

Year	Quantity of byproducts				Rough equivalent in heating value (billion B. t. u.)					Coal equivalent	
	(1) Coke breeze (thousand net tons)	(2) Surplus gas (billion cubic feet)	(3) Tar produced (thousand gallons)	(4) Light oil produced (thousand gallons)	(5) Coke breeze (1 x 20)	(6) Surplus gas (2 x 550)	(7) Tar (3 x 0.150)	(8) Light oil (4 x 0.130)	(9) Total (5+6+7+8)	(10) Net tons (9 ÷ 0.0262)	(11) Percent this form of coal made into coke
1913	735	64	115,145	3,000	14,700	35,200	17,272	390	67,562	2,600,000	3.8
1914	667	61	109,901	8,464	13,340	33,550	16,485	1,100	64,475	2,461,000	4.8
1918	1,999	158	263,299	87,562	39,980	86,900	39,495	11,383	177,758	6,785,000	8.0
1942	4,600	585	740,176	246,025	92,000	321,800	111,026	31,983	556,809	21,252,000	21.1
1943	4,790	592	738,167	250,511	95,800	325,600	110,725	32,566	564,691	21,553,000	21.0

COKE-OVEN GAS

Table 49.—*Coke-oven gas produced and sold in the United States in 1943, by States*

State	Active plants	Produced (M cubic feet)	Used in heating ovens (M cubic feet)	Surplus sold or used			Wasted (M cubic feet)
				(M cubic feet)	Value		
					Total	Average	
Alabama	8	80, 151, 439	35, 619, 752	41, 638, 986	$3, 599, 234	$0. 086	2, 892, 701
California	1	6, 701, 201	2, 116, 146	2, 770, 474	(1)	(1)	1, 814, 581
Colorado	1	12, 877, 197	6, 515, 834	6, 221, 067	(1)	(1)	140, 296
Illinois	10	49, 870, 356	15, 233, 181	32, 987, 980	5, 283, 168	. 160	1, 649, 195
Indiana	5	114, 101, 972	48, 466, 371	64, 488, 007	10, 793, 061	. 167	1, 147, 594
Maryland	1	26, 883, 411	8, 897, 017	17, 618, 852	(1)	(1)	367, 542
Massachusetts	2	18, 378, 293	3, 711, 056	14, 618, 186	(1)	(1)	49, 051
Michigan	6	43, 481, 512	7, 937, 967	35, 463, 458	5, 009, 061	. 141	80, 087
Minnesota	3	13, 754, 678	5, 753, 645	7, 871, 903	1, 907, 487	. 242	129, 130
New Jersey	2	16, 058, 390	3, 061, 198	12, 997, 192	(1)	(1)	----------
New York	8	80, 651, 581	21, 308, 998	59, 041, 095	15, 478, 837	. 262	301, 488
Ohio	15	147, 284, 316	63, 392, 180	78, 860, 713	9, 272, 724	. 118	5, 031, 423
Pennsylvania	13	266, 340, 306	106, 600, 191	157, 952, 488	17, 370, 447	. 110	1, 787, 627
Tennessee	1	3, 352, 844	1, 471, 500	1, 821, 154	(1)	(1)	60, 190
Utah	2	5, 157, 700	2, 429, 159	2, 424, 000	(1)	(1)	304, 541
Washington	1	200, 000	111, 247	88, 753	(1)	(1)	----------
West Virginia	5	41, 637, 870	11, 550, 068	29, 919, 094	2, 448, 754	. 082	168, 708
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	33, 571, 452	6, 587, 264	25, 491, 972	5, 900, 279	. 231	1, 492, 216
Undistributed	------	----------	----------	----------	11, 557, 133	. 197	----------
Grand total, 1943	90	960, 454, 518	350, 762, 774	592, 275, 374	88, 620, 185	. 150	17, 416, 370
At merchant plants	43	216, 218, 412	49, 352, 175	161, 342, 699	39, 462, 156	. 245	5, 523, 538
At furnace plants	47	744, 236, 106	301, 410, 599	430, 932, 675	49, 158, 029	. 114	11, 892, 832
Grand total, 1942	88	944, 879, 637	344, 412, 807	585, 455, 085	88, 823, 807	. 152	15, 011, 745

[1] Included under "Undistributed."

TABLE 50.—*Disposal of surplus coke-oven gas in the United States in 1943, by States*

State	Used by producer—						Sold					
	Under boilers			In steel or other affiliated plants			Distributed through city mains			Sold for industrial purposes		
	M cubic feet	Value		M cubic feet	Value		M cubic feet	Value		M cubic feet	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
Alabama	6,980,258	$248,938	$0.036	25,129,301	$2,345,113	$0.093	7,453,088	$822,097	$0.110	2,078,339	$183,086	$0.088
California				2,770,474	(1)	(1)						
Colorado				6,221,067	(1)	(1)						
Illinois	2,561,927	256,456	.100	5,702,003	952,340	.167	21,383,169	3,705,434	.173	3,340,881	368,938	.110
Indiana	2,871,302	288,148	.100	50,149,834	5,720,421	.114	7,333,599	3,669,303	.500	4,133,272	1,115,189	.270
Maryland				10,491,050	(1)	(1)	7,127,802	(1)	(1)			
Massachusetts	11,553	(1)	(1)	766	(1)	(1)	14,471,108	(1)	(1)	134,759	(1)	(1)
Michigan	2,256,844	295,797	.131	28,650,115	3,904,756	.136	145,920	39,144	.268	4,410,579	769,364	.174
Minnesota	539,432	27,905	.052	2,790,993	447,804	.160	4,541,478	1,431,778	.315			
New Jersey				309	(1)	(1)	12,996,883	(1)	(1)			
New York	1,861,188	172,692	.093	12,142,816	1,335,064	.110	42,718,242	13,599,083	.318	2,318,849	371,998	.160
Ohio	3,882,733	349,526	.090	61,154,036	6,659,295	.109	8,009,194	1,661,051	.207	5,814,750	602,852	.104
Pennsylvania	3,877,738	370,238	.095	123,560,255	10,927,609	.088	19,679,516	4,705,161	.239	10,834,979	1,367,439	.126
Tennessee	458,670	(1)	(1)				1,362,484	(1)	(1)			
Utah	1,434,704	(1)	(1)	129,026	(1)	(1)	680,294	(1)	(1)	179,976	(1)	(1)
Washington							88,753	(1)	(1)			
West Virginia	11,333,612	737,400	.065	16,526,520	1,442,898	.087				2,058,962	268,456	.130
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,800,400	162,191	.090				21,797,411	5,542,885	.254	1,894,161	195,203	.103
Undistributed		140,276	.074		1,048,466	.099		9,418,274	.256		50,117	.159
Grand total, 1943	39,870,361	3,049,567	.076	345,418,565	35,683,766	.103	169,788,941	44,594,210	.263	37,197,507	5,292,642	.142
At merchant plants	21,186,021	1,444,261	.068	2,526,093	373,509	.148	117,690,158	34,444,537	.293	19,940,427	3,199,759	.160
At furnace plants	18,684,340	1,605,306	.086	342,892,472	35,310,167	.103	52,098,783	10,149,673	.195	17,257,080	2,092,883	.121
Grand total, 1942	49,414,260	3,990,716	.081	335,290,705	34,935,356	.104	169,530,544	45,782,434	.270	31,219,576	4,115,301	.132

[1] Included under "Undistributed."

TAR

TABLE 51.—*Coke-oven tar produced, sold, and used by producers in the United States in 1943, by States*

State	Produced (gallons)[1]		Sold					Used by producer (gallons)[2]			On hand Dec. 31 (gallons)
	Total	Per ton of coal coked	For use as fuel[3] (gallons)	For refining into tar products (gallons)	Total			As fuel under boilers	In open hearth or affiliated plants	Otherwise	
					Gallons[4]	Value					
						Total	Average				
Alabama	61, 306, 901	8. 36	9, 863, 870	33, 887, 828	43, 751, 698	$2, 570, 197	$0. 059	663, 470	14, 123, 700	182, 565	3, 002, 482
California	6, 127, 678	10. 92		157, 197	157, 197	[5]	[5]				85, 357
Colorado	10, 955, 000	10. 38		113. 875	113, 875	[5]	[5]				335, 702
Illinois	39, 434, 712	7. 63	891, 243	36, 359, 610	37, 250, 853	2, 047, 599	. 055			500	1, 686, 006
Indiana	65, 508, 725	5. 87	1, 694, 040	44, 963, 099	46, 657, 130	2, 195, 952	. 047	980, 655		3, 073, 039	4, 686, 879
Maryland	21, 711, 853	7. 67		21, 242. 746	21, 242, 746	[5]	[5]			1, 150	3, 278, 295
Massachusetts	13, 043, 459	7. 85		13, 127, 043	13, 127, 043	[5]	[5]				112, 512
Michigan	31, 283. 460	7. 64		25, 074, 355	25, 074, 355	1, 293, 283	. 052		5, 312, 708		2, 109, 224
Minnesota	8, 499, 755	6. 61		8. 105, 957	8, 105, 957	478, 174	. 059			48, 435	764, 722
New Jersey	11, 288, 266	7. 97		11, 087, 966	11, 087, 966	[5]	[5]				462, 400
New York	63. 567, 886	8. 50	701, 084	48, 703, 102	49, 404, 186	2, 810, 591	. 057			38, 629	5, 302, 010
Ohio	103. 519, 980	7. 25		86, 247, 491	86, 247, 491	4, 990, 315	. 058		15, 649, 181	374, 911	3, 615, 966
Pennsylvania	232, 709, 727	9. 62	1, 470, 322	43, 494, 104	44, 964, 426	2, 052, 273	. 046	327, 942	49, 415, 883	699, 920	9, 477, 244
Tennessee	2, 485, 163	6. 95		2, 502, 425	2, 502, 425	[5]	[5]				32, 530
Utah	4, 336, 451	10. 62	29	4, 182, 051	4, 182, 080	[5]	[5]			105	314, 274
Washington	234, 837	10. 33	159, 043		159, 043	[5]	[5]				75, 794
West Virginia	38, 191, 688	10. 34		37, 453, 900	37, 453, 900	2, 061, 286	. 055		727, 312	2, 900	1, 048, 016
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	23, 961, 427	7. 89		24, 156, 466	24, 156, 466	1, 248, 859	. 052			397	756, 604
Undistributed						2, 821, 233	. 054				
Grand total, 1943	738, 166, 968	8. 11	14, 779, 631	440, 859, 215	455, 638, 846	24, 569, 762	. 054	1, 972, 067	85, 228, 784	4, 422, 551	37, 146, 107
At merchant plants	170, 050, 340	8. 40	940, 671	165, 049, 818	165, 990, 489	8, 784, 793	. 053			3, 376	6, 341, 929
At furnace plants	568, 116, 628	8. 14	13, 838, 960	275, 809, 397	289, 648, 357	15, 784, 969	. 054	1, 972, 067	85, 228, 784	4, 419, 175	30, 804, 178
Grand total, 1942	740, 175, 619	8. 41	2, 589, 695	443, 007, 596	445, 597, 291	24, 155, 601	. 054	1, 177, 945	94, 387, 192	1, 670, 873	31, 738, 564

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[1] Includes 91.824,209 gallons of tar "refined at plant" and 112,803,787 gallons of tar "topped."

[2] Excludes 91,824,209 gallons of tar "refined at plant" and 112,803,787 gallons of tar "topped."

[3] Comprises 618,115 gallons of tar sold to affiliated corporations and 14,161,516 gallons sold to other purchasers.

[4] Includes 19,221,855 gallons of crude tar sold to affiliated coke plants which was included in the 91,824,209 gallons of tar "refined at plant" and the 112,803,787 gallons of tar "topped."

[5] Included under "Undistributed."

AMMONIA

TABLE 52.—*Coke-oven ammonia produced and sold in the United States in 1943, by States*

State	Active plants	Sulfate equivalent of all forms (pounds)		Produced as—		Sold as—				On hand Dec. 31 (pounds)	
		Total	Per ton of coal coked	Sulfate (pounds)	Liquor (NH₃ content) (pounds)	Sulfate		Liquor (NH₃ content)		Sulfate	Liquor (NH₃ content)
						Pounds	Value	Pounds	Value		
Alabama	8	174,423,799	23.78	145,434,583	7,247,304	149,481,831	$2,029,716	7,198,913	$278,481	1,229,480	114,951
California	1	11,958,714	21.30	11,958,714		11,022,874	(1)			935,840	
Colorado	1	23,605,648	22.36	23,605,648		26,705,830	(1)			539,170	
Illinois	8	97,069,715	19.61	75,834,291	5,308,856	76,636,900	754,579	5,199,779	(1)	2,570,873	190,433
Indiana	5	183,684,583	16.47	157,590,583	6,523,500	156,747,610	1,945,720	6,460,214	217,129	2,779,124	228,289
Maryland	1	54,315,968	19.19	54,315,968		51,763,790	(1)			4,024,228	
Massachusetts	2	28,564,416	17.18	25,294,800	817,404	25,728,800	(1)	817,106	(1)	256,000	18,340
Michigan	5	85,862,400	20.99	28,734,328	14,282,018	28,726,100	(1)	12,368,560	467,449	31,698	243,333
Minnesota	3	22,775,773	17.72	22,775,773		23,960,930	288,934			715,675	
New Jersey	2	27,643,912	19.52	27,643,912		27,217,220	(1)			1,376,520	
New York	8	149,769,980	20.03	117,677,380	8,023,150	116,958,060	1,624,078	7,925,520	304,300	8,068,201	180,374
Ohio	15	273,393,144	19.16	217,602,664	13,947,620	219,104,017	2,730,709	12,557,217	478,681	4,416,932	537,534
Pennsylvania	13	524,287,927	21.75	517,852,923	1,608,751	538,973,689	6,947,624	1,350,368	(1)	27,595,109	200,844
Tennessee	1	7,388,121	20.68	7,388,121		7,364,560	(1)			109,800	
Utah	2	10,815,892	26.50	10,815,892		11,490,900	(1)			760,756	
West Virginia	3	57,093,969	23.69	57,093,969		56,769,220	687,804			803,940	
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	62,732,046	20.92	20,920,362	10,452,921	20,976,735	286,527	10,776,385	389,801	581,397	268,665
Undistributed							2,709,034		271,609		
Grand total, 1943	83	1,795,386,007	20.32	1,522,539,911	68,211,524	1,549,629,066	20,004,725	64,654,062	2,407,450	56,794,743	1,982,763
At merchant plants	33	386,076,911	20.76	223,574,003	40,625,727	226,071,950	3,125,834	37,765,098	1,394,319	6,399,966	979,135
At furnace plants	50	1,409,309,096	20.20	1,298,965,908	27,585,797	1,323,557,116	16,878,891	26,888,964	1,013,131	50,394,777	1,003,628
Grand total, 1942	82	1,805,025,721	20.85	1,533,608,185	67,854,384	1,503,828,945	19,460,205	63,875,140	2,238,367	87,352,849	2,031,142

[1] Included under "Undistributed."

LIGHT OIL AND ITS DERIVATIVES

TABLE 53.—*Coke-oven crude light oil produced in the United States and derived products obtained and sold in 1943, by States*

State	Active plants	Produced (gallons)		Refined on premises (gallons)	Derived products obtained and sold			On hand December 31 (gallons)
		Total	Per ton of coal coked		Produced (gallons)	Sold [1]		
						Gallons	Value	
Alabama	8	20,088,217	2.74	19,001,294	16,254,319	15,618,576	$2,386,065	293,040
California	1	1,412,407	2.52	1,391,544	1,178,495	968,198	(2)	20,863
Colorado	1	3.270,218	3.10	3,265,827	3,010,447	2,910,360	(2)	21,600
Illinois	6	11,988,804	2.56	9,612,057	6,891,387	6,879,097	1,070,200	355,702
Indiana	5	24,403,348	2.19	26,958,700	24,024,629	23,718,511	3,571,280	287,526
Maryland	1	10,242,393	3.62	10,203,831	8,513,961	8,491,027	(2)	120,657
Michigan	4	11,818,720	2.94	6,659,635	5,964,774	5,878,465	811,809	232,665
New York	8	20,397,414	2.73	34,303,259	29,959,569	30,277,606	4,679,629	297,190
Ohio	15	39,570.043	2.77	34,186,272	27,478,008	27,036,970	4.069,298	612,237
Pennsylvania	13	74,806,988	3.10	74,653,903	63,914,259	63,400,221	9,537,694	1,129,988
Tennessee	1	857,532	2.40	859,899	772,440	782,993	(2)	5,253
Utah	1	1,587,446	4.07	1,588,163	1,138,897	1,149,023	(2)	9,200
West Virginia	5	13,530,997	3.66	11,435,300	9,939,787	8,040,773	1,326,590	106,619
Connecticut, Kentucky, Massachusetts, Minnesota, Missouri, New Jersey, and Wisconsin	9	16,536,568	2.47	11,773,318	9.891,112	9,471,806	1,603,674	456,389
Undistributed							2,088,217	
Grand total, 1943	78	250,511,095	2.83	245,893,002	208,932,084	204,623,626	31,144,456	3,948,929
At merchant plants	30	48,421,566	2.53	49,774,773	42,228,012	40,507,096	6,331,653	1,475,669
At furnace plants	48	202,089,529	2.91	196,118,229	166,704,072	164,116,530	24,812,803	2,473,260
Grand total, 1942	74	246,024,882	2.88	241,854,110	206,155,160	197,261,798	28,046,207	8,818,153

[1] Excludes 17,195,002 gallons of crude light oil valued at $1,541,698, sold as such.
[2] Included under "Undistributed."

NAPHTHALENE

TABLE 54.—*Crude naphthalene produced and sold by byproduct-coke-oven operators in the United States, 1939–43*

Year	Produced (pounds)	Sold			Receipts per ton of coke (cents)
		Pounds	Value		
			Total	Average per pound (cents)	
1939	48,460,171	46,551,432	$727,947	$0.016	$0.017
1940	72,426,443	72,522.476	1,248.051	.017	.023
1941	84,046,676	83,879,396	1,522,518	.018	.026
1942	95,612,788	95.039,639	1,941,626	.020	.031
1943	98,096,899	98,031,058	2,088,829	.021	.033

BYPRODUCT-COKE OVENS OWNED BY CITY-GAS COMPANIES (PUBLIC UTILITY PLANTS)

Byproduct-coke ovens operated by city-gas companies contributed vitally needed coke and byproducts valued at $56,440,179 to the coking industry in 1943. Although more emphasis is placed upon the production of gas of proper analysis than upon the grade of coke obtained, viewed from supply and demand for coal and coke, they are definitely a part of the byproduct industry and are included in the current statistics compiled by the Bureau of Mines. The difference in classification is maintained in the interest of those who may want information on the operations of city-gas works proper.

During 1943, 17 byproduct plants owned by city-gas companies contributed 4,005,156 tons of coke or 6 percent of the total production of the byproduct industry, an increase of 311,749 tons over 1942 when 16 plants were active. A summary of the operations of city-gas plants (public utilities) in relation to the byproduct industry as a whole is presented in the following table:

TABLE 55.—*Production of coke, breeze, gas, and byproducts in the United States at byproduct-coke plants owned by city-gas companies (public utilities* [1]*) and at all other byproduct-coke plants, 1942–43*

Product	1942			1943		
	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total
Number of active plants	72	16	88	74	17	91
Coke:						
Production.....net tons	58,601,502	3,693,407	62,294,909	59,737,520	4,005,156	63,742,676
Value	$348,619,972	$29,391,995	$378,011,967	$391,508,237	$32,616,892	$424,125,129
Average per ton	$5.95	$7.96	$6.07	$6.55	$8.14	$6.65
Screenings or breeze:						
Production.....net tons	4,329,511	270,519	4,600,030	4,476,352	313,217	4,789,569
Sales.....do	912,652	19,470	932,122	1,269,717	22,192	1,291,909
Value	$2,495,558	$60,427	$2,555,985	$3,857,203	$62,873	$3,920,076
Average per ton	$2.73	$3.10	$2.74	$3.04	$2.83	$3.03
Coal charged into ovens:						
Quantity.....net tons	82,749,694	5,224,127	87,973,821	84,445,201	5,573,740	90,018,941
Coke:						
Used by producer:						
Quantity.....do	43,135,628	1,219,014	44,354,642	36,236,162	1,282,909	37,519,071
Value	$238,573,063	$8,201,546	$246,774,609	$234,982,819	$8,628,110	$243,610,929
Sold:						
Quantity.....net tons	15,522,951	2,582,992	18,105,943	23,910,517	2,820,713	26,731,230
Value	$110,614,001	$22,117,108	$132,731,109	$160,567,898	$24,787,457	$185,355,355
Byproducts:						
Gas:						
Production.....M cubic feet	885,399,111	59,480,526	944,879,637	898,774,771	61,679,747	960,454,518
Sales of surplus:						
Used under boilers:						
Quantity.....do	49,403,214	11,046	49,414,260	39,832,047	38,314	39,870,361
Value	$3,987,367	$3,349	$3,990,716	$3,037,681	$11,886	$3,049,567
Used in steel or affiliated plants:						
Quantity.....M cubic feet	335,290,705	----------	335,290,705	345,418,565	----------	345,418,565
Value	$34,935,356	----------	$34,935,356	$35,683,766	----------	$35,683,766
Distributed through city mains:						
Quantity.....M cubic feet	117,181,422	52,349,122	169,530,544	116,458,904	53,330,037	169,788,941
Value	$27,301,899	$18,480,535	$45,782,434	$27,444,204	$17,150,006	$44,594,210
Sold for industrial use:						
Quantity.....M cubic feet	27,660,835	3,558,741	31,219,576	32,568,881	4,628,626	37,197,507
Value	$2,994,472	$1,120,829	$4,115,301	$3,827,020	$1,465,622	$5,292,642
Tar:						
Production.....gallons	691,626,865	48,548,754	740,175,619	688,712,749	49,454,219	738,166,968
Sales:						
Quantity.....do	397,409,041	48,188,250	445,597,291	406,277,899	49,360,947	455,638,846
Value	$21,595,088	$2,560,513	$24,155,601	$21,928,180	$2,641,582	$24,569,762
Average per gallon	$0.054	$0.053	$0.054	$0.054	$0.054	$0.054

See footnote at end of table.

TABLE 55.—*Production of coke, breeze, gas, and byproducts in the United States at byproduct-coke plants owned by city-gas companies (public utilities*[1]*) and at all other byproduct-coke plants, 1942–43*—Continued

Product	1942			1943		
	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total
Byproducts—Continued.						
Ammonia:						
Production (NH_3 equivalent of all forms) pounds	426,031,332	25,225,098	451,256,430	422,353,696	26,492,806	448,846,502
Liquor (NH_3 content):						
Production pounds	64,198,324	3,656,060	67,854,384	63,213,793	4,997,731	68,211,524
Sales do	60,280,429	3,594,711	63,875,140	59,778,192	4,875,870	64,654,062
Value	$2,134,065	$104,302	$2,238,367	$2,265,545	$141,905	$2,407,450
Sulfate:						
Production pounds	1,447,332,033	86,276,152	1,533,608,185	1,436,559,612	85,980,299	1,522,539,911
Sales do	1,415,334,330	88,494,615	1,503,828,945	1,464,271,206	85,357,860	1,549,629,066
Value	$18,247,787	$1,212,418	$19,460,205	$19,031,112	$1,180,554	$20,211,666
Crude light oil:						
Production gallons	238,051,465	7,973,417	246,024,882	242,233,948	8,277,147	250,511,095
Sales do	12,085,223	2,830,186	14,915,409	13,853,874	3,341,128	17,195,002
Value	$1,016,992	$230,081	$1,247,073	$1,252,921	$288,777	$1,541,698
Light oil derivatives:						
Production gallons	199,097,945	7,057,215	206,155,160	203,487,830	5,444,254	208,932,084
Sales do	190,028,510	7,233,288	197,261,798	198,995,938	5,627,688	204,623,626
Value	$26,929,688	$1,116,519	$28,046,207	$30,355,787	$788,669	$31,144,456
Naphthalene, crude:						
Production pounds	94,452,435	1,160,353	95,612,788	96,616,023	1,480,876	98,096,899
Sales do	93,704,188	1,335,451	95,039,639	96,447,540	1,583,518	98,031,058
Value	$1,913,215	$28,411	$1,941,626	$2,059,635	$29,194	$2,088,829
All other byproducts, value	$10,944,458	$75,121	$11,019,579	$11,283,440	$62,219	$11,345,659

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[1] Byproduct ovens built by city-gas companies, some of which are operated in conjunction with coal, oil, and water-gas plants. Does not include independent byproduct plants, which may sell gas to public utility companies for distribution.

FUEL BRIQUETS AND PACKAGED FUEL [1]

By G. S. Goodman

SUMMARY OUTLINE

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SUMMARY

The fuel-briquetting industry showed the effect of the war, now in its third year of United States participation, by greatly increased production in 1943; conversely, the packaged-fuel industry experienced a sharp decrease and 29 plants shut down—some permanently. This contrasting development probably is due to the fact that the fuel-briquetting industry, with comparatively few but large long-established, well-organized plants, was generally able to meet the increased demand for fuel supplies; whereas the packaged-fuel industry, with its numerous small plants (principally in retail coal yards), has suffered especially from the shortage of labor, raw fuels, and paper.[2] The paper situation has become critical owing to the enormous demand for packaging materials needed for the armed forces; however, the War Production Board is making every effort to meet 1944 paper requirements.

It is noteworthy that the fuel-briquetting industry achieved its record production with plants already in existence, utilizing reserve capacity. It would appear, therefore, that these plants can easily be adjusted to normal markets in post-war years, should history repeat itself.

Because of the nature of the materials involved, for the duration the manufacture of briquetting equipment is subject to approval and priorities by the War Production Board; used equipment, however, is not subject to priorities. No installations of new fuel-briquetting or packaged-fuel equipment were reported by the machine manufacturers in 1943. As in 1942, some manufacturers reported their plants diverted to making equipment for briquetting ferro-alloys, ores, and other war materials [3] and to perfecting their small fuel-briquetting and packaged-fuel presses for increased production and better quality of product at lower cost in anticipation of an active market after the war.

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[1] Directories of fuel-briquetting and packaged-fuel plants operating in 1943 and names of manufacturers of equipment will be furnished on request by the Bureau of Mines, Washington 25, D. C.

Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Data on employment and principal expenses in the manufacture of fuel briquets may be obtained from the Bureau of the Census; 1939 is the latest year for which such data have been collected.

Briquets made from charcoal, wood scrap, and fruit pits are not included in the Bureau of Mines review.

[2] Black Diamond, Chicago and Central Western Market: Vol. 110, No. 4, February 20, 1943, pp. 46–49; Detroit, Toledo, and Cleveland (Special Correspondence and News Notes): Vol. 111, No. 4, August 21, 1943, pp. 46, 51, and 53; St. Louis (Special Correspondence): Vol. 111, No. 9, October 30, 1943, p. 41.

[3] Steel, Briquetting Machine—Supplies Charge and Feed Ore in Cubes: Vol. 112, No. 2, January 11, 1943, pp. 82–84.

Coal Heat, Use Eberling Presses for War Purposes: Vol. 44, No. 3, September 1943, p. 62.

The Solid Fuels Administration for War[4] has been actively engaged in maintaining production in all branches of the solid fuels industries, including briquetting. Utilization of Pennsylvania anthracite fines is a part of this program. Close control by the S. F. A. W. of the distribution of bituminous coal, domestic coke, and briquets has made coupon rationing of coal unnecessary thus far.

Production of fuel briquets in the United States continued the upward climb begun in 1939 and reached a record high of 2,163,998 net tons in 1943—a 24-percent increase over 1942; the output of packaged fuel, considered separately in this report, amounted to 215,605 net tons—a 15-percent decrease from 1942. The combined output in 1943 totaled 2,379,603 tons valued at $17,514,842.

Producers reported that ceiling prices prohibited profitable operation in many plants. This situation was improved on January 11, 1944, when the Office of Price Administration issued Amendment 27 to Maximum Price Regulation 121, which gave fuel-briquetting and packaged-fuel producers an opportunity to file applications before February 29, 1944, for individual increases in their maximum prices in effect on November 23, 1943. The work of the O. P. A. on coal-price control has served to avoid the enormous advance in prices of World War I, when the average value of fuel briquets at the plant in the Central States rose from $4.73 in 1916 to $6.81 in 1917 and to $8.17 in 1918; in 1940, 1941, 1942, and 1943, comparable average values of fuel briquets in the Central States were $6.95, $7.09, $7.04, and $7.44 per ton, respectively.

Records have been collected on the production of fuel briquets since 1907, when it was but 66,524 tons, with 11 plants in operation. Data on packaged fuel collected since 1935 show a phenomenal record of growth through 1940, but production has declined each year since then as a result of general wartime conditions.

Technologic developments.—Research continued in 1943, although a number of projects in the laboratory stage have been laid aside for the duration in favor of military work.

Installation of the commercial-scale briquetting press designed by R. J. Piersol[5] at the Illinois State Geological Survey has been completed, and investigations on briquetting various Illinois coals have continued with special reference to the contour of the briquet and the metallurgical composition of briquetting dies.

In 1940 Dr. Piersol reported that deduster dust and sludges from many Illinois coals contain large quantities of fusain, which is relatively smokeless. The results of his findings have been published and patented.[6]

The technical and economic study of packaged fuel by V. F. Parry,[7]

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[4] Solid Fuels Administration for War, Regulation 21, issued March 31, 1944, and effective April 1, 1944.

[5] Piersol, R. J., Briquetting Illinois Coals Without a Binder by Compression and by Impact: Illinois State Geol. Survey Rept. of Investigations 31, 1933, 70 pp.; Briquetting Illinois Coals Without a Binder by Impact: Illinois State Geol. Survey Rept. of Investigations 37, 1935, 75 pp.; Smokeless Briquets; Impacted Without Binder from Partially Volatilized Illinois Coals: Illinois State Geol. Survey Rept. of Investigations 41, 1936, 30 pp.

[6] Piersol, R. J., Smoke Index: A Quantitative Measurement of Smoke (Paper read before 34th Annual Convention, Smoke Prevention Association of America, Inc., 1940, St. Louis, Mo.): Manual of Ordinances and Requirements, S. P. A., 1940, pp. 20–22; New Data in Regard to Burning Illinois Coal in Hand-Fired Furnaces (Paper read before the 35th Annual Convention, Smoke Prevention Association of America, Inc., 1941, Atlanta, Ga.): Manual of Ordinances and Requirements, S. P. A., 1941, pp. 84–87; New Information on Coal in the Field of Physics: Illinois Geol. Survey Bull. 68, 1944, pp. 50–57; and U. S. Patent 2,321,238, Smokeless Briquette, June 8, 1943: Coal Age, vol. 48, No. 7, July 1943, p. 117.

[7] Parry, V. F., Technical and Economic Study of Packaged Fuel: Bureau of Mines Rept. of Investigations 3757, 1944, 45 pp.

Fuels and Explosives Service of the Bureau of Mines, begun in 1941, has recently been released. Another study by V. F. Parry,[8] assisted by J. B. Goodman, on the briquetting of subbituminous coals was issued in June 1943.

FUEL BRIQUETS

Salient statistics of the fuel-briquetting industry from 1939 to 1943 are summarized in the following table. Detailed data for earlier years, beginning with 1907, are to be found in annual issues of Mineral Resources (part II) and Minerals Yearbook, which include chapters on briquetting. Production and value from 1917 to 1943, inclusive, are presented graphically in figure 1.

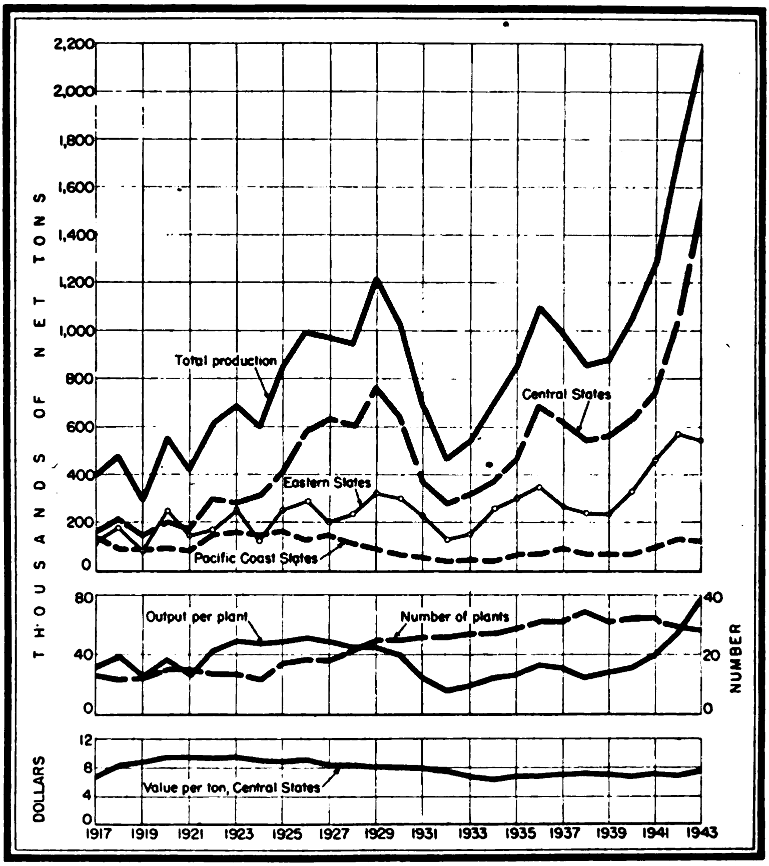

FIGURE 1.—Production of fuel briquets, output per plant, number of plants in operation, and average value per ton, f. o. b. plant (Central States), 1917–43.

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[8] Parry, V. F., and Goodman, J. B., Briquetting of Subbituminous Coal: Bureau of Mines Rept. of Investigations 3707, 1943, 37 pp.

Salient statistics of the fuel-briquetting industry in the United States, 1939–43

[Data regarding packaged fuel are given separately at end of this chapter]

Year	Production				Imports	Exports[1]	Consumption[2]	Value of production (thousands of dollars)	Plants in operation	Average output per plant (thousands of net tons)	Average value per net ton, f. o. b. plant		
	Eastern States	Central States	Pacific Coast States	Total							Eastern States	Central States	Pacific Coast States
	Thousands of net tons												
1939	243	574	75	892	1	13	880	5,802	31	29	$4.23	$7.15	$8.96
1940	331	652	68	1,051	------	23	1,028	6,439	32	33	3.95	6.95	8.84
1941	458	752	89	1,299	(3)	40	1,259	8,002	32	41	4.21	7.09	8.36
1942	565	1,048	135	1,748	(3)	104	1,644	11,266	30	58	4.56	7.04	9.69
1943	545	1,493	126	2,164	(3)	175	1,989	15,148	28	77	5.04	7.44	10.26

[1] Exports reported separately by U. S. Department of Commerce beginning with 1937.
[2] Production plus imports minus exports.
[3] Less than 1,000 tons.

Production.—The output of fuel briquets in 1943—2,163,998 tons valued at $15,148,109—again topped all previous records and represented a 24-percent increase in tonnage and a 35-percent increase in value over 1942. The increased activity in 1943 reveals the efforts of the industry to meet increased fuel demands in the national emergency. Production in 1943 stepped up to about two-thirds of the annual capacity, reported by the operators as approximately 3,164,000 net tons.

Briquets were produced in 14 States; Wisconsin again led with more than a million tons—half of the total production—followed in order by West Virginia, Missouri, and Pennsylvania. In Missouri three plants produced a total of 188,736 tons, valued at $1,236,829. Output for the 12 States (other than Wisconsin and Missouri) that produced briquets in 1943 cannot be shown separately without revealing individual plant data.

In the Central States—representing two-thirds of the total production—marked increases over 1942 were shown by Michigan, Missouri, Illinois, and Wisconsin, in the order named.

Packaging in cartons and bagging of bulk briquets at the plants, reported by 13 operators, are merchandizing features only, used for convenience and cleanliness in the delivery of the fuel.

Production of fuel briquets in the United States, 1942–43

	1942			1943				
							Change in 1943, percent	
	Plants	Net tons	Value	Plants	Net tons	Value	Tonnage	Value
Eastern States	3	565,675	$2,580,934	4	544,786	$2,746,109	−3.7	+6.4
Central States	23	1,047,747	7,378,165	21	1,493,368	11,110,885	+42.5	+50.6
Pacific Coast States	4	134,878	1,306,942	3	125,844	1,291,115	−6.7	−1.2
	[1] 30	1,748,300	11,266,041	[1] 28	2,163,998	15,148,109	+23.8	+34.5

[1] 1942: 10 plants in Wisconsin; 3 in Missouri; 2 each in California, Illinois, Michigan, Nebraska, and West Virginia; and 1 each in Arkansas, Minnesota, North Dakota, Oregon, Pennsylvania, Washington, and Wyoming; 1943: 10 plants in Wisconsin; 3 in Missouri; 2 each in Illinois, Michigan, and West Virginia; and 1 each in Arkansas, California, Massachusetts, Minnesota, Nebraska, North Dakota, Oregon, Pennsylvania, and Washington.

The enormous supplies of bituminous slack at Lake ports have made Wisconsin the nucleus of the briquetting industry. Lake shipments of coal to American docks on Lake Superior were nearly 15 percent greater in 1943 than in the preceding year.

Production of fuel briquets in Wisconsin, 1938–43

Year	Plants	Net tons	Value	Year	Plants	Net tons	Value
1938	10	422;281	$3,085,873	1941	10	535,457	$3,870.077
1939	10	430,554	3,158.859	1942	10	750,417	5,498,748
1940	11	487,574	3.440,676	1943	10	1,070,857	8,228,671

Other large plants are located at coal mines, principally in West Virginia and Pennsylvania, and smaller operations at petroleum refineries and gas plants, mainly in the Pacific Coast area.

As briquets are used almost entirely for domestic space heating, production is normally highly seasonal; but in 1943 production was fairly constant throughout the year, indicating anticipated demand. Twenty-three of the 28 active plants, which operated every month in 1943, produced 97 percent of the total; only 1 plant was active less than 9 months.

According to the Weather Bureau,[9] temperatures in January averaged below normal in the northern third of the country, and extremely cold weather prevailed in February in the North Central States.

Monthly production of fuel briquets in the United States, 1941–43, in net tons

Month	1941	1942	1943	Month	1941	1942	1943
January	135,532	170,991	187,201	August	109,487	112,434	204,424
February	118,596	122,083	192,201	September	107,257	139,699	205,979
March	85,728	93,668	188,500	October	120,197	204,665	205,118
April	27,252	102,514	133,531	November	143,339	177,938	179,564
May	82,723	145,792	121,027	December	137,166	197,982	204,299
June	105,307	146,389	153,854				
July	126,022	134,145	188,300		1,298,606	1,748,300	2,163,998

Value.—As sales realizations on briquets in the scattered producing centers vary considerably, an average value per ton for the entire industry has doubtful significance, because of the different conditions under which briquets are manufactured and sold. The most important factors that influence the value per ton realized at any plant are costs of raw materials and labor and prices of competing fuels; hence, the trend of fuel-briquet prices in the past 5 years is indicated best in this review by the average values in the Eastern, Central, and Pacific Coast States, as shown in the last three columns of the foregoing table of salient statistics. These are the values received by producers for the total product (exclusive of delivery charges) and not the prices paid by consumers—retail prices in certain cities are shown in a separate table. Some plants are distant from the markets they serve; and transportation charges and the margin of the wholesaler or retailer, sometimes both, must be added to the value at the plant.

The total value of fuel briquets manufactured in 1943 was $15,148,109, f. o. b. plant—an increase of $3,882,068 or 35 percent over 1942.

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[9] Baldwin, J. L., The Weather of 1943 in the United States: U. S. Dept. of Commerce Monthly Weather Review, vol. 71, December 1943, pp. 198–199.

Prices.—The following monthly fuel-briquet prices, available for 16 cities for 1943, except as otherwise indicated, are based upon cash delivery in 1-ton (2,000-pound) lots for retail sales to household consumers at the curb or into the customer's bin (without extra handling or additional charge). Owing to war conditions, there have been changes from month to month in the fuel-briquet market in 1943, which have affected the comparability of the prices published monthly by the Bureau of Labor Statistics. In such instances comparable prices for the preceding month are shown in footnotes to the table.

Retail fuel-briquet prices per net ton in 1943, by cities and months [1]

City	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Baltimore, Md	$11.06	$11.06	$11.06	$11.06	$11.06	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34
Boston, Mass	13.79	14.01	14.01	14.01	14.01	14.17	14.17	[2] 14.06	14.06	14.34	14.34	14.34
Charleston, S. C	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	13.75	14.45
Chicago, Ill.[3]	12.22	12.29	12.39	12.36	12.36	12.31	12.41	12.41	12.41	12.41	12.41	12.67
Cincinnati, Ohio [4]	9.41	9.47	9.76	9.76	9.76	9.64	9.74	9.74	9.84	9.84	9.84	10.07
Columbus, Ohio [4]	9.57	9.72	9.83	9.95	9.95	9.91	9.91	9.91	9.91	9.91	9.91	10.14
Fall River, Mass	13.80	13.80	13.81	13.81	13.81	13.99	14.21	14.21	14.21	14.21	14.21	14.33
Kansas City, Mo.[3]	10.71	10.71	10.71	[5] 10.49	10.49	10.70	10.70	[6] 10.78	[7] 11.08	11.08	11.08	11.47
Louisville, Ky	8.76	8.84	9.04	[8] 9.11	9.20	9.18	9.23	9.23	9.24	9.24	9.24	9.36
Milwaukee, Wis	11.78	11.78	11.78	11.79	12.23	12.24	12.42	12.49	12.52	12.52	12.52	12.55
Minneapolis, Minn	13.11	13.13	13.49	13.49	13.49	13.72	13.88	14.09	14.09	14.09	14.09	14.09
Norfolk, Va	11.50	11.50	11.80	11.80	11.80	11.75	11.75	11.75	11.75	11.75	11.75	12.00
Richmond, Va	11.37	11.39	([9])	([9])	([9])	([9])	([9])	([9])	([9])	([9])	([9])	([9])
St. Louis, Mo.[3]	10.91	10.91	11.13	11.13	11.13	11.25	11.25	11.25	11.25	11.25	11.25	11.59
St. Paul, Minn	13.11	13.12	13.48	13.49	13.49	13.68	13.86	14.09	14.09	14.09	14.09	14.09
Washington, D. C.[10]	11.60	11.60	11.60	11.60	11.60	12.04	12.04	12.04	12.04	12.04	12.04	12.24

[1] Preliminary figures; compiled from reports of Retail Price Division, Bureau of Labor Statistics.
[2] Comparable July price, $14.06.
[3] Includes 2 percent sales tax.
[4] Includes 3 percent sales tax.
[5] Comparable March price is $10.49.
[6] Comparable July price is $10.78.
[7] Comparable August price is $11.08.
[8] Comparable March price is $9.11.
[9] Data not available.
[10] Price per ton of 2,240 pounds.

Number of plants.—Twenty-eight briquetting plants reported production in 1943, and all but one (in Massachusetts) were also active in 1942. In March 1943 the Binkley Coal Co. leased its briquetting plant at Kansas City, Mo., to the Universal Coal Washing Co., which took over operations as lessee. No new plants went into production in 1943. Ten plants were idle in 1943, of which 4 were active and 6 idle in 1942. Four plants went out of business during the year. Two of these (the Fuel Blox Corporation, at Omaha, Nebr., and the California Fuel & Utilities, Inc., at Compton, Calif.), which were active in 1942, had been using petroleum coke as raw fuel; and two had been idle for several years.

Five plants were reported under construction in 1943, but of these only two appeared to be near the commercial-production stage. These were the plant of the Ecco Manufacturing Co., formerly of Providence, R. I. (purchased by the American Briquet Co., moved to the site of the Lincoln anthracite culm bank near Pine Grove, Schuylkill County, Pa., and scheduled to start operations in January 1944 [10] as the Ecco Manufacturing Co., subsidiary of the American Briquet Co.), and the plant of Western Carbon & Chemical, Inc., at Minot, N. Dak., to start manufacturing briquets from lignite char about July 1944, recovering valuable byproducts in the process.

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[10] Saward's Journal, New Anthracite Briquet Plant: Vol. 26, No. 50, March 11, 1944, p. 611.

Fires were reported by two operators—the Coal Processing Corporation, at Buckner, Ill., and the St. Louis Package Fuel Co., St. Louis, Mo.

Size of plants.—The total annual capacity of the 28 active plants was approximately 3,164,000 tons and the production 2,163,998 tons or about 68 percent of their possible tonnage in 1943. Of the 12 plants reporting annual capacities of over 100,000 tons, 7 produced well over 100,000 tons each in 1943. The average output of the individual plants increased 33 percent—from 58,000 in 1942 to 77,000 in 1943. Twenty-three plants operated every month in 1943 and produced 2,101,771 tons (97 percent of the total).

The largest production at any one plant in 1943 was reported by the Stott Briquet Co., located at the coal docks on Lake Superior, followed in order of production by the Berwind Fuel Co. plant at Superior and the United Coal & Dock Co. plant at Milwaukee.

Classification of briquetting plants in the United States, 1942-43, by size of output and annual capacity

Output (net tons)	Plants		Annual capacity (net tons)	Plants	
	1942	1943		1942	1943
Less than 2,000	2	2	Less than 5,000	1	1
2,000 and less than 5,000	3	2	5,000 and less than 10,000	2	2
5,000 and less than 10,000	5	2	10,000 and less than 25,000	7	6
10,000 and less than 25,000	5	5	25,000 and less than 100,000	9	7
25,000 and less than 100,000	9	10	100,000 and less than 200,000	7	8
100,000 and over	6	7	200,000 and less than 400,000	2	1
			400,000 and over	2	3
	30	28		30	28

Raw fuels.—Bituminous slack, either alone or in combination with other fuels, was used at 20 plants in 1943 and represented 65 percent of the total production; anthracite briquet production has increased over 1942; and production of briquets made of other raw fuels decreased, principally because of withdrawal of petroleum coke from the market for domestic purposes [11] and the labor shortage in the lignite mines serving the briquetting plant at Dickinson, N. Dak. Production of briquets at plants at Lake Superior docks increased 56 percent over 1942; the next largest increase in production was at plants near bituminous-coal mines in Illinois and mines in Arkansas that produced semianthracite.

Six operators reported washing the raw fuel before its manufacture into briquets.

Classification of fuel-briquetting plants in the United States in 1943, by kinds of raw fuel used

Kind of raw fuel used:	Plants
Anthracite and semianthracite fines	6
Mixture of anthracite and bituminous coal	6
Mixture of anthracite, bituminous coal, and petroleum coke [1]	1
Bituminous:	
Low-volatile	14
High-volatile	1
Semicoke (lignite char)	1
Residual carbon from pyrolysis of natural gas	1
Residual carbon from manufacture of oil gas	2
	[2] 32

[1] Relatively small tonnage of petroleum coke of a type exempt from wartime allocation.

[2] 4 plants made 2 kinds of briquets; hence, the sum of these items exceeds the total number of plants.

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[11] Coal Dealer, War Production Board Freezes Stocks of Petroleum Coke: Vol. 39, No. 7, November 1942, 23. War Production Board, Petroleum Coke Conservation Order M-212, March 1943.

Raw fuels used in making fuel briquets in the United States, 1942–43

Raw fuel	Net tons		Percent of total	
	1942	1943	1942	1943
Anthracite and semianthracite culm and fine sizes	386,947	592,050	23.4	28.5
Bituminous slack	1,077,474	1,341,013	65.3	64.6
Residual carbons from oil-gas manufacture and natural-gas pyrolysis; petroleum coke;[1] and semicoke (lignite char)	187,207	143,381	11.3	6.9
	1,651,628	2,076,444	100.0	100.0

[1] Relatively small tonnage of petroleum coke of a type exempt from wartime allocation.

Production of fuel briquets, 1942–43, grouped according to location of plants with reference to supply of raw fuel

Location of plant	1942		1943		Change in 1943	
	Plants	Production (net tons)	Plants	Production (net tons)	Net tons	Percent
At or near Lake Superior, Lake Michigan, or Lake Huron coal docks:						
Lake Superior	4	443,880	4	691,407	+247,527	+55.8
Lake Michigan	7	338,556	7	443,376	+104,820	+31.0
Lake Huron	1		1			
	12	782,436	12	1,134,783	+352,347	+45.0
At or near coal mines:						
Eastern States	3	565,675	3	544,671	−21,004	−3.7
Central States	6	223,860	6	320,492	+96,632	+43.2
	9	789,535	9	865,163	+75,628	+9.6
At or near petroleum refineries and oil- and natural-gas plants:						
Central States	1	163,294	1	153,354	−9,940	−6.1
Pacific Coast States	5		3			
	6	163,294	4	153,354	−9,940	−6.1
At other locations:						
Eastern States			1	10,698	−2,337	−17.9
Central States	3	13,035	2			
	[1] 3	13,035	[2] 3	10,698	−2,337	−17.9
Total United States	30	1,748,300	28	2,163,998	+415,698	+23.8

[1] Jackson, Mich., and Omaha, Nebr.
[2] Fall River, Mass., Jackson, Mich., and Omaha, Nebr.

Binders.—Asphaltic pitch continues to be the preferred binder in briquetting coal and coke. Approximately 124,000 tons of asphaltic types and small quantities of starch and coal-tar pitch were used in 1943 in the manufacture of fuel briquets. The use of asphalt or tar products in briquetting has not been restricted by the Petroleum Administration for War, although their use for certain other purposes has been curtailed for the duration.

No operators reported recarbonization of briquets to drive off smoke after leaving the presses. Whether or not the finished product will be of the smoky type depends primarily on the type of raw fuel used.

Classification of briquetting plants in the United States in 1943, by type and percentage of binder used

Type of binder	Plants	Production of fuel briquets		Ratio of binder to raw fuel (by weight)	Plants	Production of fuel briquets	
		Net tons	Percent of total			Net tons	Percent of total
Asphaltic pitch	22	1,796,838	83.0	Less than 5 percent	4	234,747	10.8
Asphaltic and coal-tar pitches	1	251,349	11.6	5 and less than 7 percent	13	829,953	38.4
Asphalt and starch	1			7 and less than 9 percent	6	983,487	45.4
Starch	[1] 2			9 percent and over	2		
No binder	[2] 3	115,811	5.4	No binder	[2] 3	115,811	5.4
	[1] 29	2,163,998	100.0		28	2,163,998	100.0

[1] 1 plant changed from starch to asphalt binder in 1943; hence, the sum of these items exceeds the total number of plants.

[2] 2 plants use residual carbon from manufacture of oil gas, and 1 uses bituminous coal as raw fuel.

Weight and shape.—Pillow-shaped briquets (under 5 ounces, with one exception), made at 23 plants continue to be the most popular in the United States.

Prevailing weight of briquets produced in the United States in 1943

Weight (ounces)	Plants	Production		Weight (ounces)	Plants	Production	
		Net tons	Percent of total			Net tons	Percent of total
Less than 2	3	58,054	2.7	6 and under 10	----------	----------	----------
2 and under 3	11	1,138,159	52.6	10 and under 16	1	99,949	4.6
3 and under 4	7	679,681	31.4	16 and under 25	2		
4 and under 5	4	188,155	8.7				
5 and under 6	----------	----------	----------		28	2,163,998	100.0

Shape of fuel briquets produced in the United States, 1942–43

Shape	1942			1943		
	Plants	Production		Plants	Production	
		Net tons	Percent of total		Net tons	Percent of total
Pillow	24	1,250.360	71.5	23	1,668,557	77.1
Cylindrical	3	478,906	27.4	3	495,441	22.9
Cube	4	19,034	1.1	2		
	[1] 31	1,748,300	100.0	28	2,163,998	100.0

[1] 1 plant made both pillow and cube shapes; hence, the sum of these items exceeds the total number of plants active in 1942.

Shipments.—It is not possible to show the shipments from each State because there are only one or two producers in each producing State except Wisconsin and Missouri, and the operations of individual companies would thus be revealed. For a graphic presentation of the centers of production, with corresponding States of destination for 1928 and 1936, see Minerals Yearbook, 1937 (p. 965, fig. 65).

Shipments of fuel briquets of domestic manufacture, 1942–43, by States of destination, as reported by producers, in net tons [1]

State	1942	1943	State	1942	1943
Arkansas	376	215	Nebraska	35, 111	38, 693
California	17, 798	11, 093	New Hampshire	2, 551	2, 565
Connecticut	1, 544	1, 558	New Jersey	1, 139	2, 149
Delaware	516	345	New York	26, 097	31, 158
District of Columbia	520	644	North Carolina	12, 894	12, 775
Florida	503	444	North Dakota	96, 912	94, 172
Georgia	178	143	Ohio	54, 699	53, 179
Illinois	65, 709	85, 174	Oklahoma	61	
Indiana	48, 868	48, 071	Oregon	77, 204	82, 048
Iowa	47, 392	61, 150	Pennsylvania	21, 999	26, 784
Kansas	10. 731	12, 018	Rhode Island	4, 070	4, 502
Kentucky	4, 954	3, 757	South Carolina	4, 890	3, 965
Maine	6, 254	6, 386	South Dakota	73, 744	84, 585
Maryland	3, 765	3, 855	Vermont	195	129
Massachusetts	38, 978	37, 719	Virginia	17, 370	17, 518
Michigan	107, 576	112, 335	Washington	21, 505	15, 256
Minnesota	303, 497	487, 122	West Virginia	322	813
Missouri	172, 269	202, 562	Wisconsin	317, 627	425, 285
Montana	73		Wyoming	409	
				1, 600, 300	1, 970, 146

[1] Shipments include resales that might have been shipped to Canada or to other States of destination. For official export statistics see table "Briquets exported from the United States, 1942–43, by countries of destination and customs districts."

Generally rail movement represents shipments to considerable distances, and shipments by truck represent local and nearby consumption. As indicated in the table,[12] virtually all tonnages move by rail from the Eastern States, over three-fourths by rail from the Central States, and the greater portion by truck from the Pacific Coast States.

Direct shipments of fuel briquets by rail and truck, 1942–43, as reported by producers, in net tons [1]

Produced in—	1942			1943		
	Rail	Truck [2]	Total	Rail	Truck [2]	Total
Eastern States	550, 220	16, 244	566, 464	527, 476	16. 846	544, 322
Central States	829, 858	212, 584	1, 042, 442	1, 193, 399	295, 647	1, 489, 046
Pacific Coast States	27, 746	88, 434	116, 180	22, 646	85, 751	108, 397
Total United States	1, 407, 824	317, 262	1, 725, 086	1, 743, 521	398, 244	2, 141, 765

[1] Includes shipments outside the United States.
[2] Includes local deliveries.

Imports and exports.—The quantity of fuel briquets imported into the United States before 1922 was negligible. The anthracite shortages of 1922–23 and 1925–26, however, created a demand for European briquets (mostly from Germany, Belgium, and France and mainly for consumption in the anthracite-consuming States), which in 1926 reached a record of 123,593 net tons. Imports continued at a comparatively high level in the following years through 1932, when they amounted to 80,288 tons, but thereafter they dropped sharply and since the beginning of the war in September 1939 have virtually ceased. Figures for imports of briquets since 1919, the first year of record, are included in annual volumes of Mineral Resources and Minerals Yearbook.[13]

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[12] Beginning of series (rail and truck shipments) 1938 Minerals Yearbook, 1939, p. 918; 1939–40, Minerals Yearbook, Review of 1940, p. 921; and following Yearbooks.

Briquets (coal and coke) and other composition coals for fuels imported for consumption in the United States, 1939–43

Year	Net tons	Value	Year	Net tons	Value
1939	1, 344	$5, 752	1942	334	$1, 739
1940	------	------	1943	196	1, 151
1941	162	791			

Wartime fuel requirements are shown by the table of exports.[14] Shipments to Canada in 1943 amounted to 174,774 tons, an increase of 69 percent over 1942. Exports to other countries were negligible in 1943.

Briquets (coal and coke) exported from the United States, 1942–43, by countries of destination and customs districts

	1942		1943	
	Net tons	Value	Net tons	Value
COUNTRY				
Brazil	249	$2, 616	------	------
Canada	103. 371	765, 138	174, 774	$1,364,199
Chile	279	3, 068	------	------
Cuba	------	------	(1)	6
Falkland Islands	------	------	22	560
Liberia	------	------	2	26
Mexico	12	169	175	328
Venezuela	10	130	------	------
	103, 921	771, 121	174, 973	1, 365, 119
CUSTOMS DISTRICT				
Arizona	------	------	175	328
Buffalo	22, 417	132. 205	22, 356	133, 253
Dakota	4, 975	43, 094	16, 175	130, 199
Duluth and Superior	1, 709	13, 484	6, 804	55, 398
CUSTOMS DISTRICT—Continued				
El Paso	7	$52	------	------
Maine and New Hampshire	44	228	43	$246
Michigan	36, 475	301, 162	96, 265	829, 927
New Orleans	------	------	22	560
New York	289	3, 198	2	32
Ohio	1, 428	9, 648	650	3, 213
Philadelphia	249	2, 616	------	------
St. Lawrence	36, 262	264, 877	32, 481	211, 963
San Diego	5	117	------	------
Vermont	22	90	------	------
Washington	39	350	------	------
	103, 921	771, 121	174, 973	1, 365, 119

[1] Less than 1 ton.

World production.—Data compiled and published since 1913 on world production of briquets are included in annual volumes of Mineral Resources and Minerals Yearbook.[15] Such official data on production in other countries as it has been possible to obtain since the beginning of the war in 1939 are shown in the following table.

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[13] 1919–29, Mineral Resources, 1929, pt. II, p. 32; 1930–35, Minerals Yearbook, 1936, p. 657; 1936, Minerals Yearbook, 1937, p. 964.

[14] Beginning of series 1937, Minerals Yearbook, 1938, p. 803.

[15] 1913–17, Mineral Resources, 1921, pt. II, p. 4.

World production of fuel briquets, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Algeria	68,682	(2)	(2)	(2)	(2)	(2)	(2)
Australia: Victoria [3]	396,760	420,704	421,254	(2)	(2)	(2)	(2)
Belgium	1,849,280	1,712,280	1,561,210	(2)	(2)	(2)	(2)
Bulgaria	47,106	85,770	88,496	100,000	(2)	(2)	(2)
Czechoslovakia:							
Coal	459,680	(2)	(2)	(2)	(2)	(2)	(2)
Lignite	264,482	(2)	(2)	(2)	(2)	(2)	(2)
Eire (Irish Free State)	10,725	20,501	(2)	5,337	15,446	(2)	(2)
France	8,321,000	7,475,000	(2)	(2)	(2)	(2)	(2)
Germany:							
Coal	6,785,537	6,897,245	(2)	(2)	(2)	(2)	(2)
Lignite	41,951,141	44,007,268	(2)	(2)	(2)	(2)	(2)
Hungary	373,519	441,081	(2)	(2)	(2)	(2)	(2)
Indochina	132,225	131,558	185,400	114,000	(2)	(2)	(2)
Italy	58,860	51,047	(2)	(2)	(2)	(2)	(2)
Netherlands:							
Coal	1,277,305	1,262,716	1,268,926	(2)	(2)	(2)	(2)
Lignite	49,539	60,543	68,607	(2)	(2)	(2)	(2)
Netherlands Indies	55,349	82,123	85,079	99,315	(2)	(2)	(2)
New Zealand	31,582	29,947	29,889	28,529	20,220	13,052	(2)
Poland	209,347	222,531	(2)	(2)	(2)	(2)	(2)
Portugal	7,772	19,865	(2)	(2)	(2)	(2)	(2)
Rumania	262,330	232,662	(2)	(2)	(2)	(2)	(2)
Spain	342,000	568,000	789,815	820,479	412,453	(2)	(2)
Tunisia	82,805	86,478	(2)	(2)	(2)	(2)	(2)
Turkey	14,761	37,285	14,792	24,497	28,392	(2)	(2)
United Kingdom	826,600	507,415	(2)	(2)	(2)	(2)	(2)
United States [4]	1,035,970	936,402	1,004,902	1,211,433	1,422,866	1,815,583	2,158,728
Yugoslavia	61,323	100,945	132,466	(2)	(2)	(2)	(2)
Total [5]	64,975,680	65,389,366	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed, briquets are produced in Canada and New Caledonia, but data on output are not available.

[2] Data not available.

[3] Data for year ended March 31 of year stated.

[4] Includes packaged fuel as follows—1937: 132,482 tons; 1938: 146,012 tons; 1939: 195,504 tons; 1940: 258,105 tons; 1941: 244,797 tons; 1942: 229,560 tons; 1943: 195,592 tons.

[5] Totals incomplete; they represent sum of figures given in table only.

PACKAGED FUEL

Packaged fuel is the trade name applied by the industry to a combination of briquetting and packaging of screenings compressed into 3- or 4-inch cubes and wrapped (six or eight in a package) in sturdy paper and sealed with gummed tape. The first plant producing this type of fuel was started in Detroit in the fall of 1932 by the Johnson Coal Cubing Co.[16]

Packaged fuel differs from fuel briquets. Fuel briquets must be tough and stand handling and rehandling over long distances with a minimum of degradation; be waterproof, weatherproof, and smokeless or nearly so; and hold together in the fire until nearly consumed. Packaged fuel does not need to meet all these requirements, as it is designed primarily for local or nearby consumption.

Various types of coal or coke screenings are mixed, generally with a neutral binder, to form the packaged-fuel cubes. The neat, tightly wrapped cubes make a package that withstands weathering fairly well, reduces breakage, and provides a relatively clean fuel.

The growth in popularity of packaged fuel has been due largely to its convenience and cleanliness in handling and to the fact that it may be purchased in less-than-ton lots, thus serving both seasonal and extra-seasonal needs of householders. During the recent periods of coal shortages it served to tide over customers awaiting replenishment of dealers' coal stocks.

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[16] Eberling, C. M., "Packaged Fuel" Opens New Market For Use of Screenings: Coal Heat, vol. 25, No. 4, April 1934, pp. 42, 44.

The phenomenal growth of this industry from 1935 through 1940 and its decline since then as a result of the war are illustrated strikingly in figure 2.[17] The demand for packaged fuel, however, has not declined and could be met only in part in 1943 because of the industry's inability to make it. Scarcity and high costs of labor, raw fuels, and paper[18] have combined to reduce the volume of production, closing down many plants and forcing the liquidation of others.

Manufacturers of packaged-fuel machinery reported no sales of new presses in 1943, but used machinery has been installed at a number of plants.

Fires severely damaged three plants in 1943, which indicates the advisability of fireproof structures for housing the equipment and care in storing raw fuels and binder materials.

Processes.—No new presses or types of machinery were reported in use in 1943 by the packaged-fuel industry. In 1943, 66 of the 72 operators used the Eberling process;[19] 4 operators used Leemon[20] packaged-fuel equipment; 2 used Glenn-Smith[21] equipment; and the Johnson Coal Cubing Co.,[22] of Detroit, Mich., uses a process and equipment of its own design. Two plants used both Eberling and Leemon equipment.

In 1939 the Viking Machinery Co., of Jackson, Mich., developed a process and machine, virtually automatic throughout, for making packaged fuel. No plants in the United States are now equipped with this machinery; five contracts for such installations in the States were canceled in 1941 owing to priorities and the paper shortage.

Salient statistics of the packaged-fuel industry from 1939 to 1943 are summarized in the following table.

Salient statistics of the packaged-fuel industry in the United States, 1939–43

[Data regarding fuel briquets are given separately at beginning of this chapter]

Year	Production (thousands of net tons)			Value of production (thousands of dollars)	Plants in operation	Average output per plant (thousands of net tons)	Average value per net ton, f. o. b. plant	
	Eastern and Pacific Coast States	Central States	Total				Eastern and Pacific Coast States	Central States
1939	9	207	216	1,867	103	2	$9.69	$8.62
1940	8	277	285	2,392	106	3	10.12	8.36
1941	10	260	270	2,472	103	3	10.95	9.09
1942	8	245	253	2,540	89	3	10.74	10.02
1943	[1] 5	211	216	2,367	72	3	[1] 11.55	10.96

[1] Eastern States; no packaged-fuel production in Pacific Coast States in 1943.

Production and value.—The 72 active plants in 1943 produced 215,605 net tons with a value of $2,366,733 (see fig. 2). Production decreased 15 percent from 1942 and the total value 6.8 percent. Output declined in 9 of the 12 producing States; of the three largest—Michigan, Wisconsin, and Minnesota, in the order named—Wisconsin and Minnesota showed increases in production over 1942.

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[17] See also Bureau of Mines Minerals Yearbook, 1936, pp. 658–661, and succeeding issues.
The Retail Coalman: Packaged Fuel a Growing Factor in Retailing: Vol. 79, No. 8, August 1943, pp. 10–13.

[18] Black Diamond, Chicago and Central Western Market: Vol. 110, No. 4, February 20, 1943, pp. 46–49; Detroit, Toledo, and Cleveland (Special Correspondence and News Notes): Vol. 111, No. 4, August 21, 1943, pp. 45, 51, and 53; St. Louis (Special Correspondence): Vol. 111, No. 9, October 30, 1943, p. 41.

[19] Eberling, C. M., Packaged Fuel Produced by the Eberling Process: Coal Heat, vol. 28, No. 1, July 1935, pp. 64–66.

[20] Black Diamond, vol. 102, No. 12, June 17, 1939, p. 15.

[21] Black Diamond, Briquetting Plant Solves Slack Problem: Vol. 98, No. 6, March 13, 1937, p. 60.

[22] Black Diamond, A Mammoth Package Fuel Plant: Vol. 102, No. 7, April 8, 1939, p. 23.

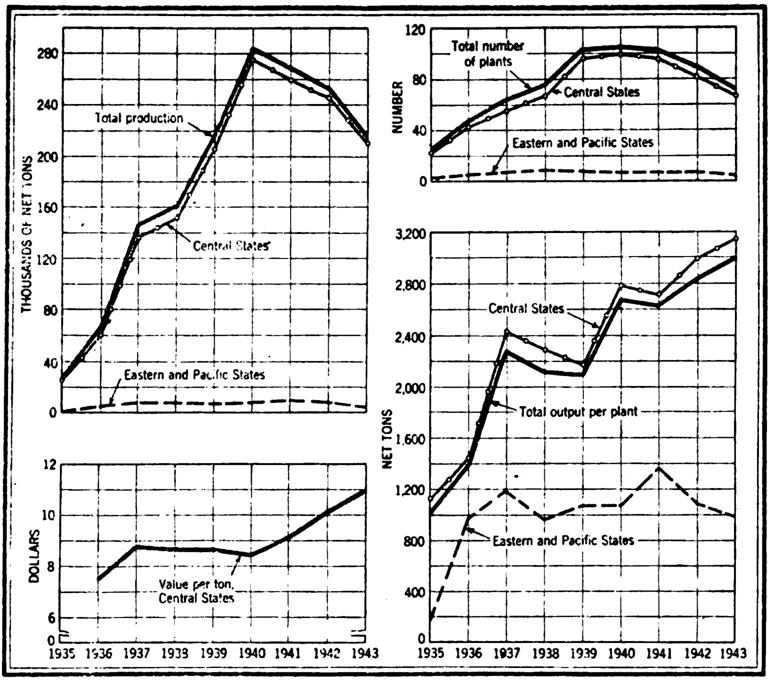

FIGURE 2.—Production of packaged fuel, number of plants in operation, average value per ton f. o. b. plant Central States, and output per plant, 1935–43. (Note: No production in Pacific Coast States in 1943.)

Production of packaged fuel in the United States, 1942–43, by States

[Plants and production not included in preceding fuel-briquet tables]

	1942			1943		
	Plants	Net tons	Value	Plants	Net tons	Value
Central States:						
Illinois	6	4,980	$60,001	4	3,081	$38,445
Indiana	5	16,698	168,882	3	12,727	128,704
Iowa	2	(1)	(1)	1	(1)	(1)
Michigan	30	89,080	867,671	27	62,763	663,275
Minnesota	4	26,887	307,887	4	34,366	431,648
Missouri	3	14,088	119,578	2	(1)	(1)
Nebraska	1	(1)	(1)	1	(1)	(1)
Ohio	22	45,228	456,896	16	33,341	363,153
Wisconsin	9	41,203	398,263	9	56,839	599,541
Undistributed [2]		7,301	79,500		7,518	84,582
Total Central States	82	245,465	2,458,678	67	210,635	2,309,348
Eastern and Pacific Coast States	[3] 7	7,583	81,409	[4] 5	4,970	57,385
Total United States	89	253,048	2,540,087	72	215,605	2,366,733

[1] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[2] Includes States entered as "1" above.
[3] Maine, 2; Pennsylvania, 1; Virginia, 3; and Washington, 1.
[4] Maine, 1; Pennsylvania, 1; and Virginia, 3; none in Pacific Coast States in 1943.

The values do not represent the price per ton to the consumer, as some plants sell both to retailers and consumers, but rather the average per ton received by producers on the total product (exclusive of delivery charges). The value at the plant comprises cost of coal at the mine, freight rate, direct and indirect manufacturing costs, and profit.

A large part of the business is conducted on a pick-up or cash-and-carry basis; and in Cleveland, for example, eleven 14-pound packages are so sold for $1, an average sales realization of about $13 a ton. Naturally operators prefer business of this type.

Average value received per net ton of packaged fuel in 1942–43, by States [1]

State	1942	1943	State	1942	1943
Illinois	$12.05	$12.48	Ohio	$10.10	$10.89
Indiana	10.11	10.11	Virginia	10.06	11.27
Michigan	9.74	10.57	Wisconsin	9.67	10.55
Minnesota	11.45	12.56			

[1] Includes only those States where there were 3 or more plants in both years.

Thirty-nine of the 72 plants active in 1943 operated each month of the year, producing 79 percent of the total production; 28 operated from 6 to 11 months, inclusive; and 5 less than 5 months.

Monthly production of packaged fuel in the United States in 1941–43, in net tons

Month	1941	1942	1943	Month	1941	1942	1943
January	39,594	33,924	27,106	August	10,184	9,346	9,286
February	37,727	29,360	23,434	September	17,422	18,519	18,973
March	40,893	26,779	24,908	October	27,183	30,378	21,967
April	17,592	19,353	18,252	November	30,506	26,361	22,335
May	6,318	14,068	11,965	December	30,296	27,739	21,131
June	5,028	9,533	8,476				
July	7,101	7,688	7,772		269,844	253,048	215,605

Number of plants.—In 1943 the number of plants producing packaged fuel dropped to 72, the lowest since 1937. Sixty-seven of these were also active in 1942. One-third of the total active plants are concentrated in the Detroit and Cleveland areas. Five operations were under new ownership in 1943; of these four reported production on a small scale, and 1 expected to start production in January 1944.

Activity in number of packaged-fuel plants, 1938–43

Year	Active	New	Idle	Out of business	Year	Active	New	Idle	Out of business
1938	76	16	8	1	1941	103	7	8	14
1939	103	29	11	9	1942	89	4	16	8
1940	106	16	15	14	1943	72	[1] 5	[2] 23	[3] 9

[1] 3 in Michigan, and 1 each in Ohio and Wisconsin; all but 1 active in 1943.

[2] 8 in Michigan, 6 in Ohio, 3 in Wisconsin, 2 in Indiana, and 1 each in Iowa, Maine, Missouri, and Washington; 9 of these were also idle in 1942.

[3] 3 in Michigan, 2 in Illinois, and 1 each in Iowa, Minnesota, Ohio, and Wisconsin; 4 of these were active in 1942.

Size of plants.—The average annual production per plant increased from 2,800 tons in 1942 to 3,000 tons in 1943. According to their reports, the 72 active operations (had circumstances permitted) could have produced more than twice the total 1943 output. The Johnson

Coal Cubing Co. of Detroit, followed closely by the Cleveland-Cliffs Iron Co. of Green Bay, Wis., was the largest producer in 1943.

Classification of packaged-fuel plants in the United States, 1942–43, by size of output and annual capacity

Output (net tons)	Plants 1942	Plants 1943	Annual capacity (net tons)	Plants 1942	Plants 1943
Less than 500	[1] 20	[2] 19	Less than 5,000	52	48
500 and less than 1,000	14	12	5,000 and less than 10,000	21	13
1,000 and less than 3,000	38	28	10,000 and less than 15,000	5	4
3,000 and less than 5,000	6	3	15,000 and less than 25,000	6	5
5,000 and less than 10,000	7	5	25,000 and less than 40,000	4	1
10,000 and less than 25,000	3	3	40,000 and less than 60,000		
25,000 and over	1	2	60,000 and over	1	1
	89	72		89	72

[1] 1 of these began operations in the fall of 1942.
[2] 2 of these began operations in the fall of 1943.

Raw fuels.—Packaged fuel made of petroleum coke has virtually disappeared from the market owing to restrictions on its use as a domestic fuel.[23]

Thus far, there is no record of commercial production of packaged fuel utilizing Pennsylvania anthracite fines; however, it is understood that packaged fuel made of a mixture of Pennsylvania anthracite and bituminous slack is being favorably considered by the coal industry.

In 1943, about 158,000 tons (74 percent of the total raw fuels) were shipped-in slack from the mines and from the Lake docks; the remainder represents yard screenings. Eighteen of the 72 operators used shipped-in slack exclusively, 30 used yard screenings, and 24 used both shipped-in slack and yard screenings; in 1942, 35 operators used shipped-in slack exclusively.

Cubes measuring 3 to 3¾ inches were made at 56 packaged-fuel plants; and 4-inch cubes were made at 21 plants.

Of the 72 active plants 27 reported wrapping the cubes by machine, 13 by hand, and 32 a combination of machine and hand wrapping. Sixty-six plants wrap 6 cubes to a package, 5 plants wrap 8 to a package, and only 1 reported a package of 4 cubes. Fifty-four plants make up packages weighing under 11 pounds, and 23, packages of 11 to 16 pounds; of these, 5 plants make up packages of two weights.

Only 1 plant reported sales of packaged fuel in bulk—unwrapped—amounting to less than 100 tons.

Raw fuels used in making packaged fuel in the United States, 1942–43

Raw fuel	1942 Plants	1942 Net tons	1943 Plants	1943 Net tons
Bituminous (low-volatile)	79	210,761	69	206,059
Bituminous (high-volatile)	3	4,655	2	
Arkansas semianthracite	2	34,969	2	6,613
Petroleum coke	10		[1] 2	
	[2] 94	250,385	[2] 75	212,672

[1] These plants reported a relatively small tonnage of petroleum coke of a type exempt from wartime allocation.
[2] In 1942, 5 plants made more than 1 kind and 2 used mixtures of these fuels; in 1943, 1 plant made 2 kinds and 2 plants used mixtures of these fuels. Hence, the number of the items exceeds the total number of active plants in the respective years.

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[23] Coal Dealer, War Production Board Freezes Stocks of Petroleum Coke: Vol. 39, No. 7, November 1942, p. 23. War Production Board, Petroleum Coke Conservation Order M-212, March 1943.

Binders.—Cornstarches were used as binder by 68 plants which produced 80 percent of the total production in 1943; of these, 15 reported using 10 to 14 pounds, inclusive, of starch binder per ton of raw fuel, 32 used 15 pounds per ton, 19 used 16 to 20 pounds, inclusive, and 2 reported using over 20 pounds of binder per ton. Portland cement, in proportions from 50 to 65 pounds per ton, was used as binder by 3 plants, representing less than 1 percent of the total production. Asphalt, about 100 pounds per ton, was used by 2 plants.

About 1,900 tons of starch and 44 tons of cement were used by packaged-fuel operators in 1943.

Classification of packaged-fuel plants in the United States in 1942–43, by type and percentage of binder used

Type of binder	Plants 1942	Plants 1943	Ratio of binder to raw fuel (by weight)	Plants 1942	Plants 1943
Starch	82	67	Less than 0.5 percent		
Starch and cement	2		0.5 and less than 1 percent	65	57
Starch and asphalt	1	1	1 and less than 2 percent	19	11
Cement	2	3	2 and less than 3 percent	1	1
Asphalt	2	2	3 and less than 5 percent	2	2
			5 percent and over	2	2
	89	[1] 73		89	[1] 73

[1] 1 plant made 2 kinds of cubes using starch binder for 1 and starch and asphalt for the other; hence, the sum of these items exceeds the number of active plants.

Shipments.—Local sales (called for by passenger car or delivered by truck) account for 78 percent of the 1943 total sales; other than local (by truck to points in Wisconsin, Minnesota, Michigan, Iowa, and Illinois), 16 percent; and by rail (to points in Wisconsin, Michigan, and Minnesota), 6 percent.

Shipments of packaged fuel by method of movement, 1941–43, in net tons

Year	Shipped by truck			Shipped by rail	Total
	Local sales [1]	Other than local sales	Total truck		
1941	254,347	11,382	265,729	4,399	270,128
1942	220,063	22,203	242,266	10,944	253,210
1943	167,800	33,582	201,382	14,137	215,519

[1] Includes sales called for and delivered.

PEAT

By Joseph A. Corgan

SUMMARY OUTLINE

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SUMMARY

The production of peat in the United States in 1943, according to reports received by the Bureau of Mines, totaled 60,002 short tons, valued at $491,460. The 1943 output declined from the 1942 production of 71,500 tons, valued at $516,887, and was slightly more than half the peak United States production of 107,261 short tons in 1918. As indicated on some of the reports submitted by the operators, the decline in production is due largely to cessation of operations at many peat bogs because of a labor shortage.

Since 1940, imports of peat moss have been curtailed drastically on account of the war. In 1943, imports were 59,427 short tons, valued at $1,577,388, compared with 49,236 tons in 1942, valued at $1,219,473. No exports were reported for either year; thus, the quantity available for domestic consumption in 1943 was 119,429 tons, a slight decline from the 120,736 tons available in 1942. Virtually all of the peat produced in the United States is used for soil improvement and in mixed fertilizers. None of the operators reporting to the Bureau indicated its use as fuel.

A directory of names and addresses of operators who reported 1943 production to the Bureau of Mines has been prepared and will be sent, upon request, to interested persons.

Reserves.—About half of the States contain some peat reserves, which constitute an important part of the natural resources of the country. The total calculated as air-dried peat has been estimated to be 13,827,000,000 tons.[1] Minnesota, Wisconsin, and Michigan together contain 75 percent of the reserves, and 14 percent of the country's total is in Florida; the remainder is scattered principally throughout the New England and Pacific Coast States.

PRODUCTION

Excavating, harvesting, and drying of peat require considerable labor, hence the present labor shortage is largely responsible for the decline in peat output. The 1943 production of 60,002 net tons, as reported to the Bureau of Mines by 37 producers operating in 17 States, is comparable with 71,500 tons produced in 1942 by 41 operators in 17 States.

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[1] Soper, E. K., and Osbon, C. C., The Occurrence and Uses of Peat in the United States: Geol. Survey Bull. 728, 1922, p. 92.

The average value a ton in 1943 was $8.19, an increase of 13.3 percent over the 1942 value of $7.23. Production and value for the years 1938–43 are shown in the following table:

Peat produced in the United States, 1938–43

Year	Short tons	Value	Year	Short tons	Value
1938	45,933	$286,127	1941	86,503	$657,556
1939	55,483	362,066	1942	71,500	516,887
1940	70,097	516,865	1943	60,002	491,460

Figure 1 illustrates graphically the trend in production and value of peat from 1908 to 1926 and 1934 to 1943. No data are available for 1927 to 1933, inclusive, as the Federal Government made no canvass of the peat industry for those years.

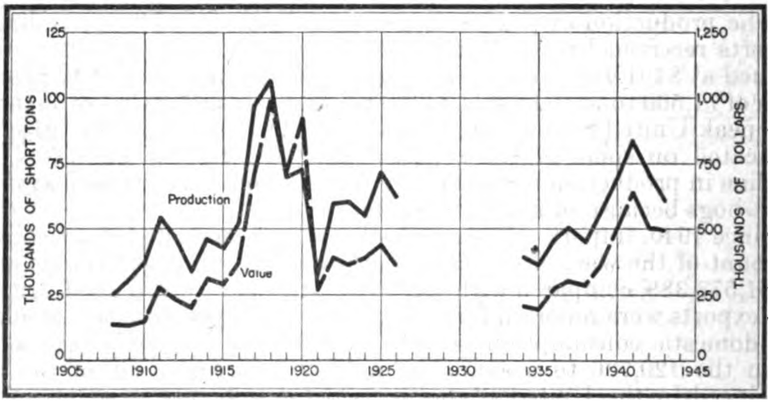

FIGURE 1.—Quantity and value of peat production, 1908–43; no data available for 1927–33.

In 1943, the producing States, in order of output, were Illinois, New Jersey, New York, Pennsylvania, Michigan, Minnesota, California, Iowa, Florida, Maine, Wisconsin, Georgia, Ohio, Texas, Massachusetts, New Hampshire, and Washington. In 1942, Illinois led in output and was followed by New York, Michigan, and New Jersey; the order of the other States also varied from that in 1943.

Peat humus comprised 45 percent of the total production, reed or sedge peat 36 percent, and moss peat 19 percent. Peat humus was produced in 9 States, reed or sedge peat in 9, and moss peat in 7.

USES

In 1943, as for many years past, a large percentage of the peat sold in the United States was used for soil improvement. In 1943, the operators reported 66 percent used for this purpose, 27 percent in mixed fertilizers, and 7 percent for other uses, including litter for barns and poultry yards. Peat is utilized also as packing for fruits, vegetables, shrubs, and fragile articles. As in previous years, no sales of peat for fuel purposes were reported. In some European countries, peat is used extensively as fuel; but, except for regional emergencies, it has not been used for this purpose on a commercial scale in this country because the supply of higher-grade fuels has been plentiful.

During the World War of 1914–18, moss peat was collected for surgical dressings, and 595,540 [2] moss-peat pads were prepared in this country and used in military hospitals both here and in Europe. Most of the moss peat was from Maine, Washington, and Oregon, and the pads were prepared under the direction of the American Red Cross. During the present war, none have been made from peat because of a shortage of trained personnel and the plentiful supply of cotton together with facilities for making surgical dressings therefrom.

United States Government specifications.—In purchasing peat, the Federal Government requires certain specifications to be met. These may be obtained from the Procurement Division, United States Treasury Department, Washington, D. C.

IMPORTS

Before 1940, Germany was the principal exporter of peat to the United States. In 1939, imports from Germany were 28,127 short tons valued at $389,597; the Netherlands and Sweden together exported 35,071 tons to the United States in the same year. In 1943, imports totaled 59,427 short tons valued at $1,577,388, all of which came from Canada. The decline in imports from other countries presented United States producers with an opportunity to increase their output of peat moss; however, the general labor shortage has prevented operators from taking full advantage of the situation.

The average value of imported peat in 1943 was $26.54, compared with $24.77 in 1942.

Peat moss imported for consumption in the United States, 1938–43

Year	Short tons	Value	Year	Short tons	Value
1938	69,509	$1,092,942	1941	30,342	$704,264
1939	78,611	1,204,883	1942	49,236	1,219,473
1940	21,689	454,632	1943	59,427	1,577,388

Peat moss imported for consumption in the United States, 1942–43, by countries

Country	Poultry and stable grade				Fertilizer grade			
	1942		1943		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Canada	36,164	$943,385	32,070	$910,898	12,936	$273,576	27,357	$666,490
United Kingdom [1]					136	2,512		
	36,164	943,385	32,070	910,898	13,072	276,088	27,357	666,490

[1] United Kingdom of Great Britain and Northern Ireland.

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[2] Hotson, J. W., Sphagnum from Bog to Bandages; Washington]Univ. Puget Sound Biol. Sta. Pub., vol. 2, No. 47, 1919, pp. 212, 243.

WORLD PRODUCTION

Unsettled conditions throughout the world have made it difficult to obtain data on the production of peat in foreign countries. The latest available data are given in the following table:

World production of peat, 1939–43, by countries [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943
Canada:					
Fuel .... metric tons..	404	27	322	156	394
Peat moss .... do....	(2)	15, 591	25, 222	48, 540	57, 728
Denmark .... do....	(2)	[3] 2, 500, 000	[3] 2, 500, 000	[3] 4, 600, 000	[3] 6, 000, 000
Eire .... do....	(2)	(2)	5, 398, 274	(2)	(2)
Finland .... do....	(2)	[3] 30, 000	[3] 100, 000	[3] 130, 000	[3] 200, 000
Latvia:					
Litter .... cubic meters..	80, 000	(2)	(2)	(2)	(2)
Waste .... do....	20, 000	(2)	(2)	(2)	(2)
Insulation .... do....	3, 000	(2)	(2)	(2)	(2)
Lithuania .... metric tons..	230, 000	(2)	(2)	(2)	(2)
Netherlands .... do....	822, 400	842, 000	(2)	(2)	(2)
Norway .... do....	(2)	(2)	[4] 60, 000	[4] 120, 000	(2)
Sweden:					
Fuel .... do....	22, 953	76, 367	[3] 400, 000	[3] 700, 000	[3] 1, 100, 000
Litter, baled .... do....	101, 883	(2)	(2)	(2)	(2)
Litter and "mull," unbaled cubic meters..	35, 724	(2)	(2)	(2)	(2)
"Mull," baled .... metric tons..	29, 220	(2)	(2)	(2)	(2)
Switzerland .... do....	15, 000	12, 000	(2)	(2)	(2)
United States .... do....	50, 333	63, 591	78, 474	64, 863	54, 438

[1] In addition to countries listed, Argentina, Austria, Estonia, France, Germany, Hungary, Italy, Poland, and U. S. S. R. produce peat, but data of production are not available.

[2] Data not available.

[3] Estimate.

[4] Estimated production of a factory at Vigra, near Aalesund.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS[1]

By A. G. White, F. S. Lott, H. A. Breakey, and A. T. Coumbe

SUMMARY OUTLINE

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GENERAL REVIEW

The outstanding change affecting the supply and demand for all oils in 1943 was the progressive improvement in the transportation situation, with the completion of new pipe lines, the expansion of the tank-car movements of crude oil and products, and an advance in tanker movements as the submarine menace was brought under control. The increased number of tankers available facilitated the shipment of domestic oil to our Allies and our expeditionary forces. The opening of the Mediterranean route made the long haul around Africa unnecessary and the shipment of larger quantities of oil from Caribbean and Persian Gulf sources possible.

The demand for all oils in the United States totaled 1,670 million barrels in 1943—an all-time record and a gain of 103 million barrels or almost 7 percent compared with 1942. The primary factor in increased demand was the rapid rise in war requirements that materialized after the first quarter of 1943. These requirements proved to be much greater than had been anticipated. The tremendous increase in the program for aviation-gasoline production was a major factor in arresting the downward trend of total motor-fuel demand. Large increments in fuel-oil supply were needed for expanding shipping and naval uses. Considering the rate of demand at the end of 1943, a much larger increase may be expected in total oil demand in 1944 than in 1943.

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[1] Data for 1943 are preliminary; detailed statistics with final revisions will be released later.

The world production of crude petroleum is estimated at about 2,222 million barrels in 1943 compared with 2,071 million in 1942—a gain of about 7 percent. The principal increases were 117 million barrels for the United States, 30 million for Venezuela, 12 million for Iraq, and possibly 11 million for the Netherlands Indies. Further substantial gains may be expected in 1944 for the United States, Venezuela, Colombia, and the Persian Gulf area.

Total demand for all oils in the United States, 1934–43

[Millions of barrels]

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
1934	920.2	114.5	1,034.7	1939	1,231.1	188.9	1,420.0
1935	983.7	129.0	1,112.7	1940	1,326.6	130.5	1,457.1
1936	1,092.7	132.0	1,224.7	1941	1,485.8	108.8	1,594.6
1937	1,169.7	172.8	1,342.5	1942	1,449.9	116.9	1,566.8
1938	1,137.1	193.7	1,330.8	1943 [1]	1,520.9	148.6	1,669.5

[1] Subject to revision.

The principal changes in the domestic supply of all oils in 1943 included a gain of almost 117 million barrels in production of crude, an increase of about 5 million barrels in the output of natural gasoline and cycle plants, a rise of 27 million barrels in total imports, and a withdrawal of only about 12 million barrels from stocks compared with a reduction in stocks of over 58 million in 1942. The record production of crude petroleum totaled 1,503 million barrels. The largest gains were 110 million barrels for Texas and 36 million for California, and the chief declines were 24 million barrels for Illinois, almost 18 million for Oklahoma, and 10 million for Mississippi. Imports of all oils rose sharply after the first quarter of 1943. There was little change in the amount of crude imported, but residual fuel-oil imports increased 8 million barrels and distillate fuel-oil imports 12 million. The 12-million-barrel decline in total stocks represented an increase of 6 million in crude stocks and a drop of 18 million barrels in stocks of refined oils. Total stocks in California were reduced 27 million barrels, whereas total stocks east of California increased 15 million.

The supply of oil for use in the West Coast States and for military and naval operations in the Pacific continued to be a major problem in 1943. Owing to the shortage of available tankers it was imperative to secure as large a supply as possible from California. The production of crude petroleum was increased from 230 million barrels in 1941 to 248 million in 1942 and to over 284 million in 1943. Heavy withdrawals from stocks have supplemented the supply. About 27 million barrels were withdrawn from stocks of all oils in 1943 compared with a reduction of 12 million in 1942. The total demand for all oils of California origin has expanded from 254 million barrels in 1941 to 275 million in 1942 and to 328 million in 1943. The total demand for residual fuel oil, the largest single product, rose from 128 million barrels in 1942 to 164 million in 1943. Gasoline production of all grades, including aviation, has been increased materially, and the supply has been augmented by overland tank-car shipments.

With completion of most pipe-line construction projects in 1943 or early 1944 and improvement in the ocean shipping situation, the major problem in oil has shifted to supply of crude. As production of crude in the United States approaches the maximum rate desirable with respect to conservation, additional oil supplies to meet war needs will depend on a larger importation of crude for refining in the United States or on a larger output from foreign refineries, particularly of fuel oils, for direct import or for shipment to our Allies or our armed forces abroad.

The 103-million-barrel gain in the total demand for all oils in 1943 consisted of a decline of 2 million barrels for motor fuel, an increase of about 64 million barrels for residual fuel oil, a gain of over 26 million barrels for distillate fuel oil, an increase of 1 million for kerosine, a gain of 3 million for lubricating oils, and an increase of 11 million for all other oils.

Salient statistics of crude petroleum, refined products, and natural gasoline in the United States, 1939–43

	1939	1940	1941	1942	1943 [1]
Crude petroleum:					
Domestic production ... thousands of barrels [2]	1,264,962	1,353,214	1,402,228	1,386,645	1,503,176
World production ... do	2,085,609	2,142,231	2,219,997	2,070,949	2,222,228
United States proportion of world production ... percent	61	63	63	67	68
Imports [3] ... thousands of barrels [2]	33,095	42,662	50,606	12,297	13,833
Exports ... do	[4] 72,076	[4] 51,496	[3] 33,238	[3] 33,834	[3] 38,341
Stocks, end of period:					
Gasoline-bearing crude ... do	239,978	264,709	247,499	234,889	243,506
California heavy crude ... do	13,330	11,906	10,179	10,865	8,289
Runs to stills ... do	1,237,840	1,294,162	1,409,192	1,334,103	1,429,738
Total value of domestic production at wells ... thousands of dollars	1,294,470	1,385,440	1,602,000	1,643,470	[6] 1,812,560
Average price per barrel at wells	$1.02	$1.02	$1.14	$1.19	$1.21
Total producing oil wells in the United States, Dec. 31	380,390	389,010	399,960	404,840	([7])
Total oil wells completed in the United States during year	17,485	19,125	19,195	10,524	9,717
Refined products:					
Imports [4] ... thousands of barrels [2]	25,965	41,089	46,536	23,669	49,666
Exports [4] ... do	116,883	78,970	75,592	83,073	110,293
Stocks, end of period ... do	268,109	282,265 [5] 280,958	290,375 [5] 294,310	247,554	229,362
Output of motor fuel ... do	611,043	616,695	701,294	608,900	610,533
Yield of gasoline ... percent	45.0	43.1	44.2	39.8	37.1
Completed refineries, end of year	547	556	522	471	([7])
Daily crude-oil capacity of refineries ... thousands of barrels [2]	4,629	4,719	4,957	4,897	([8])
Average dealer's net price (excluding tax) of gasoline in 50 United States cities ... cents per gallon [8]	9.58	9.08	9.49	10.44	10.45
Natural gasoline:					
Production ... thousands of barrels [2]	51,650	55,700	80,855	83,322	88,179
Stocks, end of period ... do	4,421	5,704	4,275 [5] 4,437	4,682	4,541

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[1] Subject to revision.
[2] 42 gallons.
[3] As reported to the Bureau of Mines.
[4] U. S. Department of Commerce; exports include shipments to noncontiguous Territories.
[5] For comparison with succeeding year.
[6] Estimated.
[7] Figures not available.
[8] Amreican Petroleum Institute.

The total demand for motor fuel fell from 695 million barrels in 1941 to 624 million in 1942 and to 622 million in 1943. The decline was due primarily to the restriction of civilian consumption by rationing to conserve gasoline, tires, and cars. War demands began to rise rapidly in 1943, stimulated by the need for more aviation gasoline. The military demand for gasoline is proving far larger than was anticipated, and the total demand for motor fuel probably will break all previous records in 1944. The yield of gasoline from crude petroleum fell from 44.2 percent in 1941 to 39.8 percent in 1942 and 37.1 percent in 1943. Stocks of finished gasoline declined about 6 million barrels during the year compared with a decline of over 15 million in 1942. Nation-wide rationing of gasoline became effective in December 1942, and civilian consumption was further curtailed by subsequent regulations. Available data, based upon State tax returns for 1943, indicate that the volume of gasoline sold for private automotive use was about one-third less than in 1941.

The total demand for residual fuel oil rose from 398 million barrels in 1941 to 418 million in 1942 and 481 million in 1943. Demand would have been much higher except for extensive conversions to coal in the East coast and rationing for heating purposes. In addition to rapidly expanding naval requirements, railroad consumption increased from 100 million barrels in 1942 to 116 million in 1943, and the quantity required for bunkering ships engaged in foreign trade more than doubled. Supply was augmented by an increase in refinery yield from 26.9 percent in 1942 to 29.2 percent in 1943, by a decline of 13 million barrels in stocks, and by an increase in imports from 18 million barrels in 1942 to almost 27 million in 1943. Demand was particularly heavy in the Pacific Coast States, where withdrawals from storage were almost 18 million barrels.

The total demand for distillate fuel oil rose from 190 million barrels in 1941 to 207 million in 1942 and to 234 million in 1943. The gain in total demand (27 million barrels in 1943) was supplied by an increase of about 15 million barrels in refinery production and by a rise of 12 million barrels in imports. Normally about 70 percent of the total domestic demand is used for space heating, but this amount was reduced to 65 percent in 1942 and underwent a further relative decline in 1943. Requirements for naval, vessel, and war industry uses have risen steadily, but consumption for heating has been restricted by rationing.

Supply and demand of all oils in the United States in 1943, by months

[Including wax, coke, asphalt, and still gas in thousands of barrels]

	1943[1]													1942 (total)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
New supply:														
Domestic production:														
Crude petroleum	117, 227	108, 399	121, 560	119, 000	123, 854	119, 302	127, 493	130, 633	130, 407	136, 503	133, 646	135, 152	1, 503, 176	1, 386, 645
Natural gasoline	7, 160	6, 640	7, 357	7, 171	7, 290	7, 052	7, 287	7, 401	7, 502	7, 834	7, 687	7, 798	88, 179	83, 322
Benzol	200	200	200	200	200	200	200	200	200	200	200	200	2, 400	2, 397
Total production	124, 587	115, 239	129, 117	126, 371	131, 344	126, 554	134, 980	138, 234	138, 109	144, 537	141, 533	143, 150	1, 593, 755	1, 472, 364
Imports:														
Crude petroleum [2]	254	....	138	179	72	454	122	2, 036	1, 568	2, 797	2, 740	3, 473	13, 833	12, 297
Refined products [3]	764	1, 989	459	2, 566	4, 110	9, 920	6, 308	9, 678	2, 909	4, 523	3, 878	2, 562	49, 666	23, 669
Total new supply, all oils	125, 605	117, 228	129, 714	129, 116	135, 526	136, 928	141, 410	149, 948	142, 586	151, 857	148. 151	149, 185	1, 657, 254	1, 508, 330
Change in stocks, all oils	+455	−275	+235	−5, 346	−2, 477	−5, 911	−1, 618	−1, 423	+324	+5, 328	+288	−1, 822	−12, 242	−58, 485
Demand:														
Total demand	125, 150	117, 503	129, 479	134, 462	138, 003	142, 839	143, 028	151, 371	142, 262	146, 529	147, 863	151, 007	1, 669, 496	1, 566, 815
Exports:														
Crude petroleum [2]	2, 031	1. 781	2, 618	2, 877	4, 389	3, 876	4, 597	3, 862	3, 441	3, 370	3, 415	2, 084	38, 341	33, 834
Refined products [3]	7, 068	5, 939	7, 114	8, 473	9, 979	8, 802	14, 048	12, 464	11, 562	9, 432	7, 814	7, 598	110, 293	83, 073
Domestic demand:														
Motor fuel	36, 130	36, 470	42, 106	48, 485	49, 993	52, 428	50, 685	52, 021	49, 699	53, 242	50, 840	48, 688	570, 787	589, 110
Kerosine	8, 096	6, 954	7, 043	5, 355	5, 070	4, 184	4, 134	3, 735	4, 383	5, 514	6, 667	7, 596	68, 731	69, 767
Distillate fuel oil	22, 195	19, 031	19, 945	15, 758	14, 378	16, 398	13, 190	16, 667	15, 078	14, 833	19, 463	21, 999	208, 935	185, 661
Residual fuel oil	34, 858	34, 070	36, 175	35, 957	36, 763	39, 469	37, 681	42, 034	38, 576	41, 130	42, 272	45, 508	464, 493	405, 697
Lubricating oil	1, 910	2, 149	2, 672	2, 748	2, 840	2, 849	2, 533	2, 942	2, 784	2, 819	2, 840	2, 480	31, 566	29, 057
Miscellaneous	12, 862	11, 109	11, 806	14, 809	14, 591	14, 833	16, 160	17, 646	16, 739	16, 189	14, 552	15, 054	176, 350	170, 616
Total domestic demand	116, 051	109, 783	119, 747	123, 112	123, 635	130, 161	124, 383	135, 045	127, 259	133, 727	136, 634	141, 325	1, 520, 862	1. 449, 908
Stocks:														
Gasoline-bearing crude in U. S	234, 958	237, 610	242, 716	243, 469	244, 415	241, 136	239, 824	237, 620	236, 822	239, 986	243, 279	243, 506	243, 506	234, 889
Heavy crude petroleum in California	10, 804	10, 394	10, 402	9, 674	9, 748	10, 064	10, 279	10, 009	8, 905	8, 716	8, 170	8, 289	8, 289	10, 865
Natural gasoline	4, 904	4, 996	5, 462	5, 425	5, 407	5, 179	5, 028	4, 893	4, 723	4, 465	4, 645	4, 541	4, 541	4, 632
Refined products	247, 729	245, 120	239, 775	234, 441	230, 962	228, 242	227, 872	229, 058	231, 454	234, 065	231, 426	229, 362	229, 362	247. 554
Total, all oils	498, 395	498, 120	498, 355	493, 009	490, 532	484, 621	483, 003	481, 580	481, 094	487, 232	487, 520	485, 698	485, 698	497, 940

[1] Subject to revision.

[2] As reported to the Bureau of Mines.

[3] Department of Commerce.

The total demand for all oils increased steadily during 1941 from a daily average of 4,107,000 barrels in the first quarter to 4,591,000 barrels in the fourth. Total demand in 1942 was about 2 percent less than in 1941. The daily average (4,538,000 barrels) was the highest for the year in the first quarter; it declined to a low of 4,082,000 barrels daily in the third quarter and rose to 4,360,000 barrels daily in the last quarter. In 1943 daily average demand for all oils set a new record of 4,573,000 barrels, a gain of about 5 percent compared with 1941 and an increase of almost 7 percent compared with 1942. Demand was at a comparatively low level in the first quarter but rose sharply in later quarters.

A brief review of the major factors in the trend of oil supply and demand by quarters, beginning with the last quarter of 1942 and extending through the first quarter of 1944, will indicate the effect of the program of the war on military and civilian oil consumption.

The daily average demand for all oils in the last quarter of 1942 was 4,360,000 barrels—a decline of 5 percent compared with the last quarter of 1941. The total demand for gasoline showed a relative decrease of over 15 percent, whereas the demand for residual fuel oil increased only 2 percent and for distillate fuel oil about 8 percent above the previous year. Gasoline rationing was established upon a Nation-wide basis in December, but its effect on total demand was obscured by heavy advance stocking by consumers. Inauguration of the rationing of heating oils in the main consuming areas on October 1 reduced potential demand materially, but the effect was modified by the substantial gain in the number of installations compared with the previous year. The small gain in residual demand indicated that the large increases in naval and railroad consumption were largely offset by the cumulative effect of conversions to coal, of increased prices, or of actual inability to procure adequate supplies in some districts.

The daily average demand for all oils declined in the first quarter of 1943 to 4,135,000 barrels—9 percent less than in the first quarter of 1942. The transportation crisis in the East coast necessitated the curtailment of nonessential driving and a cut in the unit value of heating-oil coupons. The total demand for motor fuel was only 123 million barrels, the lowest quarterly figure in 5 years and a decline of almost 19 percent compared with the first quarter of 1942. Civilian consumption was reduced to a minimum, and military demands for gasoline had not yet assumed large proportions. Owing to rationing and conversions the total demand for distillate fuel oil and the total demand for residual fuel oil were substantially less than in the first quarter of 1942. Because of transportation difficulties and the lack of balance in demand among products, crude runs to stills (3,617,000 barrels daily) were at the lowest level of the year. The average production of crude petroleum was 3,858,000 barrels daily and exceeded demand, as over 7 million barrels were added to stocks of domestic crude. The first delivery of crude through the "Big Inch" line reached Norris City, Ill., on February 19.

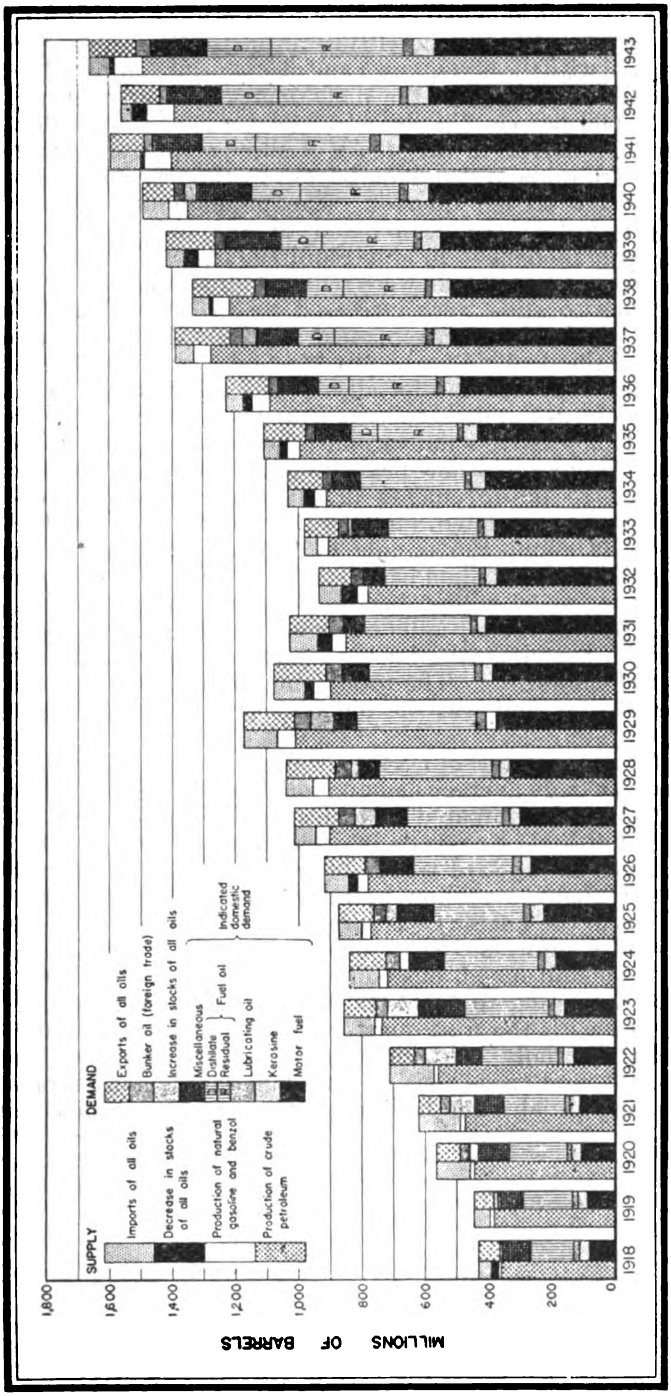

FIGURE 1.—Supply and demand of all oils in the United States, 1918–43.

The daily average demand for all oils rose abruptly to 4,564,000 barrels in the second quarter of 1943—an increase of 429,000 barrels daily, compared with the first quarter and of 9 percent compared with the second quarter of 1942. As the daily increase in crude production was only 122,000 barrels, this large demand was met by a decline of about 14 million barrels in the stocks of all oils and by an increase in total imports from about 4 million barrels in the first quarter to over 17 million in the second quarter. The predominant factor was a sudden rise in total gasoline demand to 162 million barrels that reflected a large increment in war requirements. To meet this demand, finished gasoline stocks were reduced almost 17 million barrels, and crude runs to stills were increased to 3,769,000 barrels daily. The gasoline yield, however, remained at about the low level of the first quarter as the demand for residual fuel oil was expanding rapidly.

The daily average demand for all oils was 4,750,000 barrels in the third quarter of 1943 and exceeded all previous records. Crude production (4,223,000 barrels daily) and crude runs to stills (4,062,000 barrels daily) represented new peaks in industry operations and were closely related to improvements in overland transportation. The Big Inch line was completed, and the flow of crude oil reached East Coast terminals about the middle of August. Imports of all oils amounted to almost 23 million barrels, and exports reached the highest level of the year at 50 million barrels for the quarter. Stocks of all oils declined by less than 3 million barrels, representing a decrease of over 11 million barrels in the Pacific Coast area and an increase of 8 million east of California. The total demand for motor fuel was over 171 million barrels and was the highest for any quarter since the end of 1941.

In the fourth quarter of 1943 all previous records were again exceeded, with a daily average demand for all oils of 4,841,000 barrels—a gain of 11 percent compared with the last quarter of 1942. Crude production—4,405,000 barrels daily—and crude runs—4,213,000 barrels—continued the upward trends to set new records. Stocks of all oils increased about 4 million barrels, representing a decline of 5 million barrels in the Pacific Coast States and a gain of about 9 million barrels east of California.

The total demand for all oils continued to rise in the first quarter of 1944 and amounted to 5,013,000 barrels daily—a gain of 21 percent compared with the first quarter of 1943. Crude production of 4,409,000 barrels daily was slightly above the record of the last quarter of 1943, and crude runs of 4,374,000 barrels daily represented a further substantial gain compared with any previous quarter.

The large relative gain in the first quarter was exaggerated by comparison with the abnormally low demand in the first quarter of 1943. This applied particularly to the total daily average demand for motor fuel, which increased about 32 percent. Although relative gains in subsequent quarters may be materially smaller, the total demand for all oils in 1944 promises to exceed all previous records. The completion of the new 20-inch pipe line from Texas to the East coast in March represented the last major link in the new overland transportation system.

RESERVES

Reserves of crude oil on January 1, 1944, were estimated by the American Petroleum Institute Committee on Petroleum Reserves at 20,064,152,000 barrels. These reserves include only crude oil and condensate in known and proved fields and recoverable by present production methods. Additions to reserves during 1943 totaled 1,484,786,000 barrels; but only 282,418,000 barrels represented new pools discovered during the year, and 1,202,368,000 barrels represented upward revisions of reserve estimates for fields discovered before 1943. The small decline in total reserves, amounting to about 19 million barrels during 1943, is the first that has occurred in recent years and was offset by a record production that exceeded the previous peak in 1941 by about 101 million barrels.

The failure to develop large additional reserves in the United States has stimulated interest in future sources of supply in other countries. Attention has been centered on the large potential reserves in the Persian Gulf area. The disposal of this surplus may well become the major problem in the international oil trade of the future.

The German submarine campaign was brought under control during 1943, making it possible to supplement domestic petroleum production with oil from foreign sources, and large quantities started moving into this country from the Caribbean during 1943. Steps to foster foreign supplies included the organization of the Program Division in the Petroleum Administration for War (P. A. W. Directive 70); the organization of the Petroleum Reserve Corporation; and the supplying of equipment to foreign countries for producing crude oil and the manufacturing high-octane gasoline.

The Program Division was instituted to coordinate the Petroleum Administration for War agencies on a global scale. Directive 70 was designed to bring about joint use of facilities and products in foreign operations and to operate in the interallied field to utilize tankers and other facilities to move oil over the shortest routes without cross-hauling and multiple-port loading or unloading. The Foreign Operations Committee, composed of 12 members from the industry, was charged with execution of this directive.

Estimates of proved oil reserves in the United States on January 1, 1938–44, by States [1]

[Millions of barrels]

State	1938	1939	1940	1941	1942	1943	1944
Eastern States:							
Illinois	41	243	382	315	334	307	295
Indiana	3	6	14	14	23	32	31
Kentucky	38	38	44	41	36	35	35
Michigan	49	43	51	35	56	64	55
New York	61	41	35	65	60	54	90
Ohio	28	26	32	30	37	35	33
Pennsylvania	288	200	183	188	171	153	137
West Virginia	28	24	46	53	50	47	44
	536	621	787	741	767	727	720
Central and Southern States:							
Arkansas	192	188	320	306	295	300	297
Kansas	601	613	726	692	690	687	646
Louisiana	714	1,040	1,173	1,216	1,330	1,442	1,484
Mississippi	--------	--------	7	40	80	41	39
New Mexico	547	703	687	692	675	677	654
Oklahoma	1,212	1,162	1,063	1,002	1,036	969	909
Texas	8,248	9,448	9,768	10,624	10,976	11,546	11,325
	11,514	13,154	13,744	14,572	15,082	15,662	15,354
Mountain States:							
Colorado	19	18	20	23	23	39	45
Montana	109	105	94	89	86	86	108
Wyoming	266	261	306	305	304	371	499
	394	384	420	417	413	496	652
Pacific Coast States: California	3,063	3,189	3,532	3,291	3,323	3,196	3,337
Other States	--------	--------	--------	4	4	2	1
Total United States	15,507	17,348	18,483	19,025	19,589	20,083	20,064

[1] From reports of Committee on Petroleum Reserves, American Petroleum Institute, of the amount of crude oil that may be extracted by present methods from fields completely developed or sufficiently explored to permit reasonably accurate calculations. The change in reserves during any year represents total new discoveries, extensions, and revisions minus production.

The Petroleum Reserves Corporation was organized to lend Government assistance in establishing and maintaining a national policy and position in foreign oil operations. Not only is the United States the largest world user of petroleum, but it is the chief source of capital and of skilled technicians trained in the exploration for and production of petroleum. For these reasons, this country has a vital interest in foreign sources of oil that may supplement our own reserves.

Steps to assure a future supply of motor fuel independent of foreign sources included research in the liquefaction of coal and practical aspects of refining oil shale and tar sands. The Bureau of Mines has carried on extensive research and issued a number of publications regarding the liquefaction of coal.

TRANSPORTATION

The war has caused material readjustments in the world supply and distribution of oil, and these changes have necessitated a major reorganization of internal transport in the United States.

The domestic demand for all oils in the United States rose from 1,231 million barrels in 1939 to 1,486 million in 1941. During this period our exports fell from 189 million barrels to 109 million, and imports rose from 59 million barrels to 97 million. The progressive closing of European markets reduced our exports and made larger quantities of Caribbean oil available for our use. The first indication of world transport difficulties was in the spring of 1941, when some 50 tankers were temporarily withdrawn from our own use to meet war needs abroad.

After the United States entered the war in December 1941, the problem of an adequate supply of tankers became acute. The requirements of our armed forces abroad increased rapidly. Our Allies had to depend to a greater extent on oil from this country, as other sources became unavailable, and oil had to be moved by the shortest and most direct routes. The effective service of tankers was reduced by sinkings, by the delays incident to convoying, and by use for temporary storage and supply in connection with naval and new land operations.

The tanker shortage had to be met by a major diversion from the coastal service in the United States to overseas movements for war purposes. Normally the principal boat movement was from Gulf to East Coast ports and amounted to about 1,170,000 barrels daily. Elimination of the larger part of this movement and substitution of overland methods of transportation created the most acute problem in war oil supply and involved mobilization of a vast inland system of tank-car, pipe-line, barge, and truck transport.

The first step in the adjustment of transportation was reorganization of tank-car movements. In the spring of 1941 only 5,000 barrels of oil daily entered the Eastern States by tank car. By July 1942 the movement had been increased to 800,000 barrels daily and reached a peak of about 1,000,000 barrels daily in July 1943. At the height of the movement about 80,000 tank cars, out of a national total of 107,000, were used in this service. After the 24-inch crude line from Texas to the East coast was completed, tank-car deliveries declined to about 750,000 barrels daily as cars were shifted to longer routes or to other areas. In January 1943 a box-car movement of kerosine in drums was begun to the East coast and reached a peak of 25,000 barrels daily. With the withdrawal of tank cars from local distribution service, tank-truck service increased for distances up to 200 miles.

Peacetime movement of oil by barge into the Eastern States was small. Efforts to increase this movement resulted in daily shipments of 64,000 barrels by April 1942 and a further increase to 168,000 barrels daily by September 1943. The total movements via protected waterways to the Atlantic Seaboard may reach 200,000 barrels daily by the middle of 1944, but the annual average probably will not exceed 175,000 barrels daily.

The expansion of pipe-line movements to the Midwest and Eastern States was a major objective in the overland transport program. Three new projects—the Plantation, the Southeastern, and Portland-Montreal lines—were rushed to completion in 1941. A further program was inaugurated that involved the construction, reversal, or conversion of over 11,000 miles of pipe lines. Nineteen major pipe-line projects were planned by the Petroleum Administration for War to facilitate the northward and eastward flow of crude petroleum and products. The total cost of these lines was about 260 million dollars, of which about 70 percent represented Government financial assistance. Some 7,600 miles of new line were to be constructed—62 percent using new pipe and the balance using second-hand materials. In addition, the direction of flow was to be reversed in 3,300 miles of existing lines. About 90 percent of these projects was completed by November 1943, and the balance was expected to be in operation in the first half of 1944. Total pipe-line deliveries to the East coast amounted to only 42,000 barrels daily early in 1941; by November 1943 they had risen to 450,000 barrels daily and were expected to increase further to 700,000 barrels daily when all projects were finished in 1944.

The largest single pipe-line project was construction of the Big Inch 24-inch crude line from Longview, Tex., to refineries in the New York and Philadelphia districts. The line was financed by the Federal Government at a cost of about 95 million dollars and took almost a year to construct. The first delivery was made at Norris City, Ill., on February 19, 1943, and the flow through to the East coast started on August 15. The rated capacity of the line is 300,000 barrels daily. The line consists of 1,253 miles of 24-inch pipe, 111 miles of 20-inch pipe, and an extensive feeder system.

The second-largest pipe-line project was the 20-inch products line from Beaumont, Tex., to the East coast. It was Government-financed at an estimated cost of 75 million dollars and involved 1,640 miles of new construction, including feeder lines. The rated daily capacity of the line is 225,000 barrels of gasoline. Oil started moving through the southern section of the line late in December 1943, but deliveries did not reach the East coast until early in March 1944, as breaks developed when the eastern section was tested. The line is designed primarily to transport gasoline and domestic heating oils.

ADMINISTRATION AND PRORATION

The planning and administrative measures necessary to secure an adequate supply and distribution of petroleum for civilian and war purposes are under the jurisdiction of agencies appointed by the President. The principal agencies involved are the Office of Defense Transportation, the Office of Price Administration, and the Office of Petroleum Administration for War. The Petroleum Administration for War, in addition to being made a claimant agency (an agency that has the right to claim a priority on scarce material), was given the power to issue instructions and orders relating to all phases of the industry and the means for enforcing such instructions and orders.

Among the administrative orders issued in 1943 by agencies appointed by the President were the Economic Stabilizer's refusal to grant an increase in the price of crude oil; prohibition of pleasure driving in the East Coast States; lowering, by order of the Petroleum Administration for War (P. A. W.), of the octane number and volatility of motor gasoline; and extension to foreign operations of P. A. W. Directive 59, requiring joint use of facilities and products in domestic marketing. Other orders controlled the volume of gasoline produced, required the isolation of isobutanes from butane mixtures, limited the deliveries of gasoline to dealers, and established in P. A. W. district 3 a zoning plan similar to the plan in district 1. The regulation restricting hours of operation of service stations was revoked, materials restrictions were relaxed, and restrictions on high-pressure lubricants were removed.

Early in 1942 the Office of Petroleum Coordinator assumed the function of prescribing the rates of crude-oil production for the States in place of the estimates of market demand that had been issued by the Bureau of Mines theretofore. The Bureau of Mines has continued to issue the monthly forecast of motor fuel and crude-oil requirements and to supply the Petroleum Administration for War with estimates of the market demand for crude oil for the individual States. Production recommendations by the Petroleum Administration for War include consideration of reserves and of efficient production rates, as well as market demand. They cover all petroleum liquids, including condensate and natural-gas derivatives as well as crude oil.

CRUDE PETROLEUM

SUPPLY AND DEMAND

The total demand for crude petroleum was approximately 1,511 million barrels in 1943 compared with 1,411 in 1942—a gain of 100 million barrels or about 7 percent. The demand for foreign crude petroleum declined about 2 million barrels, and the demand for domestic crude petroleum rose 102 million barrels. The increase in the total demand for crude petroleum was due to the larger demand for all oils and a much smaller reduction in the stocks of refined oils in 1943 than in 1942. Compared with 1942, the production of domestic crude petroleum increased almost 117 million barrels, crude imports increased less than 2 million barrels, and total stocks of crude oil increased 6 million barrels compared with a drop of 12 million in 1942. Total crude runs to stills rose almost 96 million barrels, exports increased almost 5 million barrels, transfers gained about 5 million barrels, and other crude for fuel and losses declined 6 million barrels.

Supply of and demand for crude petroleum in the United States, 1939–43

[Thousands of barrels]

	1939	1940	1941	1942	1943 [1]
Production	1, 264, 962	1, 353, 214	1, 402, 228	1, 386, 645	1, 503, 176
Imports [2]	33, 095	42, 662	50, 606	12, 297	13, 833
Changes in stocks [3]	−37, 314	+23, 307	−18, 942	−11, 924	+6, 041
Total supply	1, 335, 371	1, 372, 569	1, 471, 776	1, 410, 866	1, 510, 968
Runs to stills:					
Domestic	1, 204, 350	1, 252, 364	1, 358, 246	1, 319, 507	1, 417, 559
Foreign	33, 490	41, 798	50, 946	14, 596	12, 179
Exports	72, 076	51, 496	[2] 33, 238	[2] 33, 834	[2] 38, 341
Transfers to fuel oil:					
Distillate	2, 125	2, 297	2, 383	2, 484	3, 070
Residual	10, 284	7, 978	13, 099	19, 295	24, 087
Other fuel and losses	13, 046	16, 636	13, 864	21, 150	15, 732
Total demand	1, 335, 371	1, 372, 569	1, 471, 776	1, 410, 866	1, 510, 968

[1] Subject to revision. [2] As reported to Bureau of Mines. [3] Inclusive of heavy crude in California.

PRODUCTION

General.—The crude-oil output of 1,503,176,000 barrels was almost 117 million barrels greater than the amount produced in 1942 and exceeded all previous records. The largest gains in 1943 were 110 million barrels for Texas and 36 million barrels for California. Substantial increases were recorded also in Kansas, Louisiana, New Mexico, and Kentucky. The principal declines were 24 million barrels for Illinois, almost 18 million barrels for Oklahoma, and 10 million barrels for Mississippi.

Texas and California retained their position as the two leading producing States, with 39.5 and 18.9 percent of the total national output. Louisiana ranked third in the list of producers, displacing Oklahoma by a very small margin. Kansas ranked fifth with 7.1

percent of the total, and Illinois dropped from fifth place in 1942 to sixth place in 1943 with 5.5 percent of the national total.

Production in the East Texas field totaled 129,112,000 barrels in 1943—a gain of about 8 million barrels compared with 1942. Production in the Coalinga field in California increased by about 12 million barrels to 31,388,000 barrels in 1943. Other Texas fields to show large gains in 1943 were Conroe, Hastings, Hawkins, and Webster. Production in the Oklahoma City field was 20,338,000 barrels in 1943—a decline of about 6 million barrels compared with 1942.

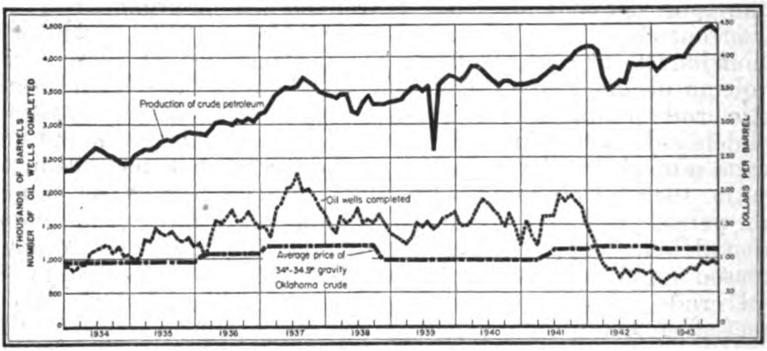

FIGURE 2.—Daily average production of crude petroleum, total number of wells completed, and average price per barrel of a selected grade of Oklahoma crude petroleum in the United States, 1934–43, by months.

Petroleum produced in the United States, 1939–43, and total, 1859–1943, by States[1]

[Thousands of barrels]

	1939	1940	1941	1942	1943[2]	1859–1943 (total)
Production:						
Arkansas	21,238	25,775	26.327	26.628	27,600	586.972
California	224,354	223,881	230,263	248,326	284,235	6,332,902
Colorado	1,404	1,626	2,150	2,199	2,320	46,565
Illinois	94,912	147,647	132,393	106,391	82,260	1,020,716
Indiana	1.711	4,978	7,411	6,743	5,283	150,547
Kansas	60,703	66,139	83,242	97,636	106,178	[3] 1,407,989
Kentucky	5,621	5,188	4,762	4.534	7,883	[4] 184,340
Louisiana	93.646	103,584	115,908	115,785	123,592	1,415,274
Michigan	23,462	19,753	16,359	21,754	20,768	[5] 203,987
Mississippi	107	4,400	15,327	28,833	18,807	67,474
Montana	5,960	6,728	7,526	8,074	7,916	107,008
Nebraska	2	276	1,808	1,237	635	4,048
New Mexico	37,637	39,129	39,569	31,544	33,411	[6] 384,283
New York	5,098	4,999	5,185	5,421	5,059	[7] 134,442
Ohio	3,156	3,159	3,510	3,543	3,322	598,752
Oklahoma	159,913	156,164	154,702	140,690	123,152	5,224,667
Pennsylvania	17,382	17,353	16,750	17,779	15,757	1,047,354
Texas	483,528	493,209	505,572	483,097	593,520	8,161,996
West Virginia	3,580	3,444	3,433	3,574	3,349	421,126
Wyoming	21,454	25,711	29,878	32,812	33,077	596,745
Other States[8]	94	71	63	45	52	1,280
Total, United States	1,264,962	1,353,214	1,402,228	1,386,645	1,503,176	28,098,467
Value at wells:						
Total (thousands of dollars)	1,294,470	1,385,440	1.602,000	1,643,470	1,812,560	33,201,409
Average per barrel	$1.02	$1.02	$1.14	$1.19	$1.21	$1.18

[1] For detailed figures by States, 1859–1935, see Minerals Yearbook, 1937, p. 1008.
[2] Subject to revision.
[3] Oklahoma included with Kansas in 1905 and 1906.
[4] Includes Tennessee, 1883–1907.
[5] Figures represent 1925–43 production only; earlier years included under "Other States."
[6] Figures represent 1924–43 production only; earlier years included under "Other States."
[7] Early production in New York included with Pennsylvania.
[8] Includes Alaska, 1912–33; Arkansas, 1920; Michigan, 1900–1919; Missouri, 1889–1911, 1913–16, 1919–23, 1932–43; New Mexico, 1913, 1919–23; Tennessee, 1916–43; Utah, 1907–11, 1920, 1924–41; Florida, 1943.

Production of crude petroleum in the United States in 1943, by districts, States, and months

[Thousands of barrels]

District and State	1943[1]												
	January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	2, 196	1, 999	2, 312	2, 197	2, 212	2, 246	2, 223	2, 191	2, 135	2, 072	2, 042	2, 040	25, 865
Other Appalachian	621	674	657	682	768	797	869	872	863	915	856	794	9, 368
Lima-Northeastern Indiana-Michigan	1, 803	1, 644	1, 815	1, 805	1, 872	1, 728	1, 768	1, 760	1, 739	1, 708	1, 639	1, 663	20, 944
Illinois-Southwestern Indiana	7, 881	7, 159	7, 798	7, 363	7, 287	7, 113	7, 214	7, 128	7, 024	7, 264	7, 111	7, 174	87, 516
Mid-Continent:													
North Louisiana, Arkansas, and Mississippi	6, 475	5, 977	6, 308	6, 241	6, 276	6, 207	6, 260	6, 196	5, 912	6, 077	5, 947	5, 929	73, 805
West Texas and Southeastern New Mexico	9, 387	8, 833	9, 564	9, 631	10, 347	9, 445	11, 348	11, 503	13, 380	14, 526	14, 017	14, 540	136, 521
East Texas	10, 159	9, 193	10, 163	10, 704	10, 658	10, 130	11, 554	11, 492	11, 523	11, 521	11, 490	11, 396	129, 983
Oklahoma, Kansas, North Texas, etc	31, 818	29, 944	33, 429	32, 051	33, 074	32, 205	33, 637	34, 128	33, 293	34, 090	33, 612	33, 589	394, 870
Gulf coast	19, 749	18, 243	21, 831	21, 538	23, 728	22, 561	24, 753	27, 380	27, 286	30, 112	29, 319	29, 822	296, 322
Rocky Mountain	3, 452	3, 120	3, 613	3, 574	3, 655	3, 591	3, 811	3, 832	3, 828	3, 840	3, 794	3, 637	43, 747
California	23, 686	21, 613	24, 070	23, 214	23, 977	23, 279	24, 056	24, 151	23, 424	24, 378	23, 819	24, 568	284, 235
Total United States	117, 227	108, 399	121, 560	119, 000	123, 854	119, 302	127, 493	130, 633	130, 407	136, 503	133, 646	135, 152	1, 503, 176
STATE													
Arkansas	2, 291	2, 113	2, 214	2, 136	2, 257	2, 303	2, 393	2, 347	2, 285	2, 421	2, 412	2, 428	27, 600
California[2]	23, 686	21, 613	24, 070	23, 214	23, 977	23, 279	24, 056	24, 151	23, 424	24, 378	23, 819	24, 568	284, 235
Colorado	198	158	170	170	200	189	205	209	200	208	201	212	2, 320
Illinois	7, 401	6, 720	7, 342	6, 914	6, 862	6, 680	6, 756	6, 691	6, 592	6, 842	6, 699	6, 761	82, 260
Indiana	482	441	458	451	427	435	460	440	434	425	414	416	5, 283
Kansas	9, 152	8, 691	9, 816	9, 331	9, 076	8, 646	8, 984	8, 882	8, 475	8, 511	8, 314	8, 300	106, 178
Kentucky	507	566	526	564	640	664	737	732	740	794	740	673	7, 883
Louisiana	9, 850	9, 150	10, 314	10, 368	10, 525	9, 690	10, 460	10, 640	10, 470	10, 944	10, 401	10, 780	123, 592
Michigan	1, 785	1, 625	1, 795	1, 784	1, 860	1, 717	1, 756	1, 747	1, 729	1, 696	1, 625	1, 649	20, 768
Mississippi	1, 766	1, 589	1, 639	1, 679	1, 655	1, 612	1, 585	1, 574	1, 470	1, 438	1, 408	1, 392	18, 807
Montana	575	572	639	634	661	656	682	678	688	696	705	730	7, 916
Nebraska	66	61	71	62	62	56	52	52	49	37	36	31	635
New Mexico	2, 999	2, 783	2, 928	3, 016	3, 159	3, 151	3, 381	3, 400	3, 341	3, 452	3, 347	3, 454	38, 411
New York	418	389	453	427	432	436	438	429	423	403	401	410	5, 059
Ohio	253	244	293	273	278	285	286	303	278	274	276	279	3, 322
Oklahoma	10, 557	9, 813	10, 846	10, 205	10, 222	10, 169	10, 341	10, 297	10, 022	10, 340	10, 102	10, 238	123, 152
Pennsylvania	1, 358	1, 229	1, 419	1, 348	1, 367	1, 368	1, 359	1, 330	1, 290	1, 246	1, 228	1, 215	15, 757
Texas	40, 941	38, 020	43, 502	43, 401	47, 160	44, 953	50, 389	53, 542	55, 314	59, 216	58, 397	58, 685	593, 520
West Virginia	296	261	295	285	272	298	281	278	274	278	264	267	3, 349
Wyoming	2, 641	2, 357	2, 766	2, 733	2, 759	2, 710	2, 887	2, 907	2, 905	2, 900	2, 853	2, 660	33, 077
Other States	5	4	4	5	4	5	5	4	4	4	4	4	[3] 52
Total United States: 1943	117, 227	108, 399	121, 560	119, 000	123, 854	119, 302	127, 493	130, 633	130, 407	136, 503	133, 646	135, 152	1, 503, 176
1942	128, 398	113, 936	114, 509	105, 149	110, 255	108, 655	111, 855	120, 568	115, 933	120, 523	116, 230	120, 634	1, 386, 645
Daily average, 1943	3, 782	3, 871	3, 921	3, 967	3, 995	3, 977	4, 113	4, 214	4, 347	4, 403	4, 455	4, 360	4, 118

[1] Subject to revision.

[2] American Petroleum Institute.

[3] Florida (4) ,Missouri (36), Tennessee (10), and Virginia (2).

Percentage of total crude petroleum produced in the United States, 1934–43, by principal States

State	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943[1]
Texas	42.0	39.4	38.9	39.9	39.2	38.2	36.4	36.1	34.8	39.5
California	19.2	20.9	19.5	18.6	20.6	17.7	16.6	16.4	17.9	18.9
Louisiana	3.6	5.0	7.3	7.1	7.8	7.4	7.7	8.3	8.3	8.2
Oklahoma	19.9	18.6	18.8	17.9	14.4	12.7	11.5	11.0	10.2	8.2
Kansas	5.1	5.5	5.3	5.5	5.0	4.8	4.9	5.9	7.0	7.1
Illinois	.5	.4	.4	.6	2.0	7.5	10.9	9.4	7.7	5.5
New Mexico	1.9	2.1	2.5	3.1	2.9	3.0	2.9	2.8	2.3	2.6
Wyoming	1.4	1.4	1.3	1.5	1.6	1.7	1.9	2.1	2.4	2.2
Arkansas	1.1	1.1	.9	.9	1.5	1.7	1.9	1.9	1.9	1.8
Michigan	1.2	1.5	1.1	1.3	1.5	1.8	1.5	1.2	1.6	1.4
Mississippi							.3	1.1	2.1	1.2
Pennsylvania	1.6	1.6	1.6	1.5	1.4	1.4	1.3	1.2	1.3	1.0
All other	2.5	2.5	2.4	2.1	2.1	2.1	2.2	2.6	2.5	2.4
Total United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Subject to revision.

Production of crude petroleum in leading fields and districts in the United States, 1942–43, and total production since discovery [1]

[Thousands of barrels]

Field	State	1942	1943	Total since discovery
East Texas	Texas	120,943	129,112	1,979,947
Wilmington	California	33,696	34,381	208,359
Coalinga	do	19,285	31,388	437,357
Oklahoma City	Oklahoma	26,484	20,338	593,736
Conroe	Texas	13,589	19,995	162,072
Bradford-Allegany [2]	Pennsylvania-New York	20,547	18,358	494,905
Hastings	Texas	10,555	17,916	63,620
Tinsley [2]	Mississippi	28,357	17,290	64,824
Seminole	Oklahoma	20,408	16,599	931,002
Gray County	Texas	13,654	15,770	214,125
Kettleman North Dome	California	13,015	15,299	280,568
Midway-Sunset	do	20,440	14,954	[3] 660,798
Hawkins	Texas	5,265	14,773	21,472
Louden	Illinois	17,961	13,702	101,382
Huntington Beach	California	12,108	13,259	326,888
Wasson	Texas	9,401	12,584	54,350
Long Beach	California	13,124	11,625	691,738
Webster	Texas	3,633	11,473	24,092
Slaughter	do	7,531	11,205	25,977
Salem	Illinois	14,705	10,220	177,218
Thompson	Texas	5,405	10,115	48,928
Yates district	do	7,481	9,548	284,877
Anahuac	do	3,740	8,839	32,485
Lance Creek	Wyoming	8,023	7,439	56,510
Santa Fe Springs	California	7,763	7,309	489,726
Monument	New Mexico	6,698	7,190	58,730
Eunice	do	5,242	6,498	65,314
Van	Texas	3,321	6,120	139,341
Rodessa	Arkansas-Louisiana-Texas	7,684	5,824	139,606
Salt Creek	Wyoming	4,719	4,806	308,060
Hobbs	New Mexico	2,928	3,780	104,161

[1] Oil and Gas Journal. [2] Bureau of Mines. [3] Revised.

Arkansas.—Production of petroleum was again moderately higher in 1943, gaining 4 percent over 1942 to 27,600,000 barrels. Material increases in output of the active Midway, Stevens, and Macedonia areas contrasted with small declines in almost all other fields.

Wildcat completions in 1943 almost doubled those of 1942, and six discoveries or major extensions of present fields were reported. Oil-well completions were 103 in 1942 and 137 in 1943, of which 48 were in the Stevens field (Hosston zone). The average initial production per well increased from 121 barrels in 1942 to 136 in 1943.

Dual completion of wells to permit simultaneous production from two horizons through concentric pipes has become a common practice in several Arkansas fields, with resultant savings of steel and capital investment. An interesting experiment in pressure maintenance by injection of fresh water has been started in the Midway field, Lafayette County. The operators believe that recoverable reserves of oil will be substantially increased by the procedure.

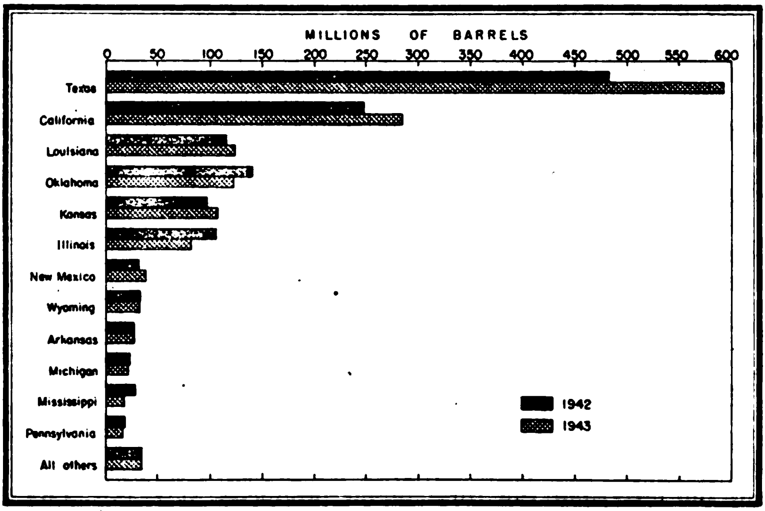

FIGURE 3.—Production of crude petroleum in the United States, 1942–43, by States.

Production of crude petroleum in Arkansas, 1939–43, by fields

[Thousands of barrels]

Year	Atlanta	Buckner	Dorcheat-Macedonia	El Dorado	Magnolia	Midway	Rodessa	Schuler	Smackover	Stephens	Urbana	Other fields	Total
1939	108	662	30	630	3,639	....	1,358	6,430	5,945	196	381	1,859	21,238
1940	721	815	409	591	7,383	....	711	6,547	5,500	196	468	[1] 2,434	25,775
1941	1,013	816	797	534	7,121	....	497	6,055	5,351	251	837	[1] 3,055	26,327
1942	1,034	765	1,012	497	6,364	1,218	366	5,913	4,907	614	985	[1] 2,953	26,628
1943 [2]	956	660	1,602	449	6,041	2,168	212	5,520	4,458	1,485	[3] 1,058	[1] 2,991	27,600

[1] Includes oil consumed on leases and net change in stocks held on leases for entire State.

[2] Subject to revision.

[3] Includes New London.

California.—In response to record demand for California oil, production increased 14 percent in 1943 over 1942 to 284,235,000 barrels, almost equaling the peak of 1929. The daily average production increased to 791,000 barrels in the last quarter and continued upward in the early months of 1944. Total output exceeded 1942 by 35,909,000 barrels of which 6,207,000 represented the gain in heavy crude to 46,923,000 barrels.

The San Joaquin Valley continued to increase its share of the State's total output, which amounted to 47 percent in 1943, with a gain of 28 million barrels. A number of fields increased their production 1 or 2 million barrels, but the largest factor was a 12-million barrel gain to 31,386,000 barrels at Coalinga, which ranked third in volume of output among fields of the United States. Midway-Sunset produced only 14,953,000 barrels in 1943, a surprising drop of over 25 percent below 1942.

In the Coastal district every important field contributed to a total increase of 6.6 million barrels (19 percent). Production of the Ventura Avenue field, which has yielded over 12 million barrels annually for many years, rose from 13,644,000 barrels in 1942 to 15,461,000 in 1943.

The Los Angeles Basin gained only 1 percent in 1943 to 110,628,000 barrels. Larger withdrawals from Dominguez, Huntington Beach, and Wilmington were almost neutralized by declines in other fields. Although Wilmington continued to be the largest producing field in California, Coalinga approached it closely in 1943 and produced more than double the output of Ventura Avenue, which ranked third, followed by Kettleman Hills and Midway-Sunset.

After a sharp decline in 1942, drilling increased rapidly in 1943 under the influence of improved oil-transportation facilities, more adequate supplies of equipment, and the urgent need for more oil. The number of oil-well completions more than doubled to total 1,150 in 1943. Of these, over 800 were in the San Joaquin Valley, 100 in the Coastal district, and 240 in the Los Angeles Basin. The most active fields were Belridge, Coalinga, Kern Front, and Midway-Sunset.

Although six new fields were discovered in the San Joaquin Valley and a number of extensions and new productive zones were opened in old fields, the total of new reserves revealed was comparatively small, far less than the total of oil produced in 1943. The most important discovery was the Pleasant Valley field about 1 mile southeast of the Coalinga Nose. The discovery well flowed 819 barrels a day from about 200 feet of Eocene sand at a depth of 9,142 feet. The field is expected to cover several hundred acres.

Production of crude petroleum in California, 1939–43, by districts and fields [1]

[Thousands of barrels]

District and field	1939	1940	1941	1942	1943 [2]
San Joaquin Valley:					
Belridge	4,781	4,614	4,185	2,917	4,543
Canal	1,855	2,034	1,816	1,069	1,446
Coalinga	5,731	9,916	14,224	19,323	31,386
Coles Levee [3]	526	2,589	5,717	5,436	5,906
Edison	838	868	1,013	1,020	900
Elk Hills	3,830	4,427	3,491	4,363	5,373
Fruitvale	2,377	2,072	2,085	2,312	2,571
Greeley	811	1,475	2,480	2,583	4,819
Kern River—Kern Front	4,133	4,082	4,315	5,707	7,274
Kettleman Hills	19,568	16,730	13,983	13,014	15,300
Lost Hills	1,222	1,405	1,263	1,398	1,328
McKittrick	1,326	1,317	1,422	1,791	1,719
Midway-Sunset	18,960	18,397	17,461	20,470	14,953
Mountain View	2,983	2,415	1,910	1,602	1,440
Mount Poso	4,314	3,425	4,117	7,566	8,432
Rio Bravo	2,875	3,304	4,534	3,579	5,446
Round Mountain	3,528	2,691	2,815	3,917	4,150
Ten Section	3,247	3,518	5,232	4,805	6,558
Other San Joaquin Valley	1,152	2,003	1,748	2,203	9,541
Total San Joaquin Valley	84,057	87,282	93,811	105,075	133,085

See footnotes at end of table.

Production of crude petroleum in California, 1939–43, by districts and fields[1]—Continued

[Thousands of barrels]

District and field	1939	1940	1941	1942	1943[2]
Coastal district:					
Capitan	876	651	740	844	1,178
Elwood	1,545	1,286	1,166	873	1,668
Gato Ridge				1,217	1,295
Rincon	1,238	1,609	1,542	1,010	1,210
San Miguelito	952	1,163	1,427	1,238	1,614
Santa Maria	6,305	2,216	3,183	2,726	3,791
Santa Maria Valley		6,096	6,908	7,550	8,303
Ventura Avenue	12,935	12,570	12,892	13,644	15,461
Ventura-Newhall	2,317	2,866	4,279	3,041	3,639
Other Coastal	132	101	87	1,805	2,363
Total Coastal	26,300	28,558	32,224	33,948	40,522
Los Angeles Basin:					
Brea Olinda	2,063	2,070	2,079	3,716	4,252
Coyote	4,013	4,053	4,466	5,848	6,502
Dominguez	7,131	7,665	8,495	7,932	9,118
Huntington Beach	9,983	9,592	10,743	12,096	13,239
Inglewood	4,605	4,366	4,901	6,750	6,913
Long Beach	17,004	16,010	14,697	13,131	11,641
Montebello	7,455	7,240	4,884	3,961	3,966
Playa del Rey	1,801	1,498	1,319	1,227	972
Richfield	3,134	3,228	2,719	2,890	2,689
Rosecrans	4,459	4,259	3,434	2,722	2,215
Santa Fe Springs	10,050	9,438	8,552	7,761	7,307
Seal Beach	2,641	2,557	2,430	3,027	2,867
Torrance	6,418	4,007	3,210	3,049	2,874
Wilmington	31,100	30,195	30,672	33,657	34,349
Other Los Angeles Basin	2,140	1,863	1,627	1,536	1,724
Total Los Angeles Basin	113,997	108,041	104,228	109,303	110,628
Total California	224,354	223,881	230,263	248,326	284,235

[1] American Petroleum Institute.
[2] Subject to revision.
[3] Includes Tupman.

Colorado.—Production increased from 2,199,000 barrels in 1942 to 2,320,000 in 1943 owing to a 227,000-barrel gain at Wilson Creek, the State's most important producing field.

Ten oil-well completions were reported in 1942 and 11 in 1943, of which 8 with average initial production of 21 barrels a day were in the Rangely field and 2 with an average production of 280 barrels were at Wilson Creek. Eight dry holes were also drilled in the Rangely area. The North McCallum field was extended, and an oil discovery was reported at Clarks Lake, Larimer County, where small production was indicated from the Muddy sand.

Production of crude petroleum in Colorado, 1939–43, by fields

[Thousands of barrels]

Year	Florence[1]	Fort Collins[2]	Iles	Moffat	Price	Rangely	Tow Creek	Wilson Creek	Other fields	Total
1939	62	116	724	112	289	36	53		12	1,404
1940	56	128	581	111	326	29	52	237	[3] 106	1,626
1941	55	118	547	116	324	220	50	453	[3] 267	2,150
1942	49	111	534	125	272	288	46	533	[3] 241	2,199
1943[4]	44	102	480	118	253	285	46	760	[3] 232	2,320

[1] Includes Canon City.
[2] Includes Wellington.
[3] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[4] Subject to revision.

Florida.—The first commercial oil production was found in 1943 at Sunniland, Collier County, in the southern part of Florida. The discovery well produced about 100 barrels of 20° A. P. I. gravity oil, with some water, from Lower Cretaceous beds at a depth of 11,626 feet. A widespread program of exploration and leasing in Florida and adjacent States was in progress at the end of the year.

Illinois.—Continuing its rapid decline since the peak (146,451,000 barrels) of 1940, Illinois produced 82,260,000 barrels in 1943 compared to 106,391,000 in 1942. Whereas about 90 percent of the net decline in 1942 occurred in the two major fields (Louden and Salem), only about 33 percent of the 1943 decline may be attributed to them. These fields are approaching the more stable condition of settled production, while many smaller fields are still showing rapid declines after dissipation of much of their reservoir energy in a brief period of intensive exploitation. The only important increase in production in 1943 was from the Phillipstown field, White County, which gained almost 1 million barrels over 1942. In the late months of 1943 production was relatively stable, however, as the increments from new wells offset declining output elsewhere.

Illinois ranked sixth among the States in oil production in 1943 and fifth in 1942, having been surpassed by Kansas. It supplied 5.5 percent of the total petroleum production of the United States in 1943, 7.7 percent in 1942.

Drilling was less active in 1943 than in 1942 or the boom year 1941. Oil-well completions were 1,046 with average initial daily production of 126 barrels, compared with 1,169 in 1942 with average initial of 168 barrels. The most active fields with new oil wells in each in 1943 were Mount Carmel, Wabash County, 87; Iola, Clay County, 68; Clay City, Clay and Wayne Counties, 54; and Phillipstown, White County, 50. Development centered in the southeastern counties near the Wabash River.

Twenty-eight discoveries were made, but none appeared of major importance. The largest new field was North Calvin, White County, in which 23 wells were drilled before the end of the year. Other active new fields were West Lancaster and South Covington. Over 150 extensions and new zones in older fields were reported. Of the tests drilled into older formations, one found production from Devonian limestone in the Patoka pool, Marion County; one produced from a Silurian limestone in the Mount Auburn pool, Christian County; and another in the Marine pool, Madison County. A number of unsuccessful tests of the Trenton were drilled on the west side of the Illinois Basin, inspired by the 1942 discovery of profitable Trenton production in the St. Jacob field, Madison County.

Secondary recovery by water flood was started in the Patoka pool, with encouraging prospects. This method is being used also in the Siggins pool, Cumberland County; in the Colmar-Plymouth pool, McDonough County; and in the Clay City area. Repressuring with natural gas continued in the Louden, Salem, and New Harmony fields and was extended to new areas in the Crawford County fields.

Production of crude petroleum in Illinois, 1939–43, by fields [1]

[Thousands of barrels]

Field	1939	1940	1941	1942	1943
Aden-North	794	1,009	700	405	458
Albion		1,095	895	499	405
Benton-North			5,769	5,488	2,534
Boyleston	169	1,306	815	669	425
Centralia	2,265	10,642	3,564	2,277	1,683
Cisne	1,224	479	219	182	159
Clay City	7,694	6,922	4,680	2,716	2,764
Covington				1,159	1,048
Dale-Hoodville		667	6,195	5,294	3,909
Dundas	209	2,341	4,438	2,505	1,295
Iron		1,120	801	470	313
Irvington		509	1,037	753	551
Johnsonville			5,913	5,146	2,170
Keensburg	987	2,709	2,002	1,710	1,138
Louden	18,351	26,596	22,918	17,961	13,702
Mount Carmel		26	1,691	1,024	854
New Harmony	5	1,503	9,939	7,224	5,257
Noble	1,644	2,744	2,507	2,607	2,518
North Boos		249	826	528	598
Parkersburg			785	1,294	595
Phillipstown	7	49	56	182	1,112
Roland		2	1,101	1,889	1,120
Rural Hill			1,570	3,738	1,715
Salem	50,179	70,734	29,539	14,705	10,220
Sims-North			12	1,706	1,488
St. James	439	1,713	1,871	1,477	1,130
Storms	42	1,514	1,398	731	463
Tonti	835	2,556	1,250	859	697
Woodlawn			2,465	2,997	1,446
Old eastern fields	2,738	3,329	3,989	4,331	4,201
Other fields	4,352	6,637	9,686	13,756	14,761
	91,934	146,451	128,631	106,282	80,729

[1] Oil and Gas Journal.

Indiana.—Production declined for the second year since the 1941 peak—from 6,743,000 barrels in 1942 to 5,283,000 in 1943—because of sharply reduced output from the State's largest pool, Griffin in Gibson and Posey Counties. Although five discoveries were reported—two in Posey County, two in Spencer, and one in Gibson—none was large. The new Gibson County field—North Owensville—appeared most important, having nine wells completed with average initial daily production of 140 barrels before the end of 1943.

The reduced drilling activity centered in Posey and Gibson Counties, which had 20 and 49 oil-well completions, respectively. The Kirksville and Caborn pools were most active. Completions of oil wells in Indiana totaled 141 in 1942 and 96 in 1943, with average initial daily production of 64 barrels.

In the old Trenton area three dry holes were drilled into the Cambrian.

Production of crude petroleum in Indiana, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	59	59	59	65	87	114	135	166	176	230	262	299	1,711
1940	203	235	329	314	337	366	400	505	516	583	609	581	4,978
1941	627	572	642	619	648	644	656	627	595	600	566	615	7,411
1942	620	524	604	594	627	588	579	571	529	532	485	490	6,743
1943 [1]	482	441	458	451	427	435	460	440	434	425	414	416	5,283

[1] Subject to revision.

Kansas.—The trend of production continued upward in 1943 to 106,178,000 barrels from 97,636,000 in 1942. About half the important fields of the State increased their output, the largest gains being in the Peace Creek and Trapp-Sellens areas. The largest sources of production, in order, were: Trapp-Sellens, Silica-Raymond, and Bemis-Walters, unchanged from 1942.

Continued declines in Oklahoma and Illinois production intensified the need for Kansas oil and further stimulated the drilling effort. In 1943 oil-well completions totaled 880, with average initial daily production of 311 barrels compared with 815 in 1942 with average initial of 693 barrels. The rate of drilling increased steadily during the year, and December completions almost doubled the number in January. The most active pools, with the number of new oil wells in each, were: Carmi 64, Kraft-Prusa 60, Lindsborg 47, Chase 36, Zenith 35, and Trapp 34.

Twenty-odd new pools and numerous extensions to old ones were opened. Development pointed to significant additions to productive areas north and west of the Barton Arch group of fields and southwestward from Hutchinson. Although results of exploration in the Salina Basin have not been outstanding, a considerable number of further tests appear to be in prospect.

The most important new development was the Carmi pool, Pratt County, where about 2,500 productive acres and 15 million barrels of reserves were indicated, according to the Oil and Gas Journal. In Stafford County several new areas were discovered, and important extensions to the Drach pool were made. The Zenith pool in Stafford was linked to the Peace Creek area, Reno County, which was extended in several directions.

Greater productive possibilities of the thick Simpson sand in Pratt County were indicated by southwest extension of the Cunningham field and other drilling in the vicinity. Discovery of the Studley pool in Sheridan County, producing from the Lansing limestone, added interest to a large prospective area in the northwestern part of the State. Extensions to the Morel pool, Graham County, and the Ray pool, Phillips County, indicated that these outpost areas may contain reserves of major proportions. Drilling in the rich Russell County area linked the Greenvale and Hall-Gurney fields. After active development in 1942 the Lindsborg pool of northern McPherson County was greatly enlarged in 1943.

Production of crude petroleum in Kansas, 1939–43, by counties and selected fields [1]

[Thousands of barrels]

County and field	1939	1940	1941	1942	1943
Barton:					
Kraft-Prusa	263	611	1,405	2,965	3,890
Silica-Raymond	5,000	5,763	7,615	9,063	9,825
Other fields	2,846	2,733	3,682	4,286	4,561
Butler:					
Eldorado	2,710	2,651	2,597	2,498	2,433
Other fields	2,353	2,394	2,633	2,202	1,916
Cowley	2,131	2,672	2,802	3,040	2,605
Ellis:					
Bemis-Walters	2,881	3,419	4,866	5,847	6,720
Burnett	254	1,771	3,291	4,097	4,948
Other fields	332	342	477	446	461

Production of crude petroleum in Kansas, 1939–43, by counties and selected fields [1]—Continued

[Thousands of barrels]

County and field	1939	1940	1941	1942	1943
Ellsworth:					
Stoltenberg	405	1,056	2,427	2,711	3,083
Other fields	616	547	473	450	407
Greenwood	3,793	3,227	3,238	3,601	3,281
Harvey	982	687	679	494	413
McPherson:					
Bornholdt-Welch	198	1,029	1,783	1,857	1,830
Graber-Hesston	965	947	951	950	619
Ritz Canton	1,753	1,373	1,366	1,145	960
Voshell	574	562	586	535	630
Other fields	377	400	600	1,006	2,132
Reno:					
Burrton	3,187	2,625	2,539	2,101	1,740
Peace Creek	------	------	36	1,650	2,914
Other fields	770	634	639	555	533
Rice:					
Chase-Campbell	2,256	2,338	2,746	3,379	3,750
Geneseo-Edwards	1,753	1,814	2,694	3,716	3,941
Other fields	1,695	1,653	1,457	1,255	1,194
Russell:					
Hall-Gurney	1,211	2,243	3,520	4,057	3,780
Trapp-Sellens	4,255	5,481	7,577	9,726	10,840
Other fields	4,272	4,709	4,826	5,758	5,813
Sedgwick	1,247	1,156	1,093	1,011	929
Stafford:					
Zenith	1,294	1,838	3,176	3,593	3,765
Other fields	1,074	1,361	2,164	3,058	3,449
Sumner	1,494	1,220	977	901	769
Other counties	5,188	5,790	7,506	8,926	11,566
	58,129	65,046	82,421	96,879	105,697

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[1] Oil and Gas Journal.

Kentucky.—Because of the phenomenal performance of the Smith Mills field in Henderson County, production in Kentucky increased 74 percent in 1943 to 7,883,000 barrels, the greatest total since 1923. A discovery of August 1942—the Smith Mills field—produced over 3.2 million barrels in 1943 from about 80 wells.

Drilling increased materially, particularly in western Kentucky, where Henderson, Union, and Daviess Counties were most active, and resulted in 243 oil wells in 1943 in contrast to only 59 in 1942. A number of tests of the Devonian and Silurian formations were drilled in western Kentucky but with small success.

Black-oil production from the old Mariamba-Denniston and Ragland oil fields in Menifee County was revived as the war demand for fuel oils created a market. Small Weir sand production was developed on the Burkes dome, Elliott County, and is expected to cause extensive exploration in 1944 in Elliott and Jackson Counties.

Production of crude petroleum in Kentucky, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	536	380	437	418	494	527	503	539	423	443	472	449	5,621
1940	383	422	435	438	442	405	454	449	444	464	424	428	5,158
1941	424	387	414	407	403	385	418	386	391	397	356	394	4,762
1942	344	335	376	356	348	355	361	337	357	408	460	497	4,534
1943 [1]	507	566	526	564	640	664	737	732	740	794	740	673	7,883

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[1] Subject to revision.

Louisiana.—Larger output from the Gulf Coast area raised Louisiana production to a new record of 123,592,000 barrels in 1943 compared with 115,785,000 in 1942. A dozen or more fields contributed to the gain of almost 10 million barrels in the Gulf Coast region, among them several recently discovered fields in an early stage of major development. The largest increases in production were reported from the Paradis, Gibson, Bayou Sale, and Lafitte fields.

Production in the Northern district declined from 29,310,000 barrels in 1942 to 27,398,000 in 1943. The output of the Haynesville field, the scene of an extensive drilling campaign in 1942, was over 700,000 barrels higher in 1943, and that of the Nebo and a few small fields increased moderately. Declines in other fields in 1943 were led by Olla, Rodessa, and Cotton Valley.

A general falling off of drilling activity reduced oil-well completions from 558 in 1942 to 336 in 1943. The Northern district declined sharply from 272 to 126, influenced by Haynesville operations, which resulted in 100 more wells in 1942 than in 1943. Gulf Coast completions were 286 in 1942 and 210 in 1943. The most active fields in 1943 were Caddo and Haynesville in the north, and Erath, Vinton, Pine Prairee, and Paradis in the Gulf Coast.

Three oil fields and two condensate fields were discovered in the Northern district in 1943. The Holly Ridge oil field, producing from the Tuscaloosa formation, in Tensas Parish, had three wells and six drilling at the year end and gave promise of important reserves. A large condensate reservoir was indicated by four scattered wells at Lucky, Bienville Parish, completed in the Pettit zone of the Sligo formation.

In the Gulf region nine oil and eight condensate discoveries were reported. The new oil fields that appear relatively important are Bear in Beauregard Parish; Reddell, Evangeline Parish, where production was found in the Wilcox and two sands in the Sparta formation; Napoleonville, the first oil field in Assumption Parish; and Hope Villa, East Baton Rouge Parish, which extended the trend of Miocene production. Condensate discoveries were made in the following parishes: Acadia (two), Beauregard, St. James, St. Landry, St. Martin, and Vermillion (two).

Many producing fields were enlarged by drilling, and over 30 new productive sands were opened. On the Vinton dome production was found in several different strata of the Frio formation. This development may encourage deep exploration in a number of old fields along the regional trend where similar conditions may be expected.

Louisiana became the third largest producing State in 1943, surpassing Oklahoma by a small margin. The State's oil comes from a relatively large number of fields of moderate productive capacity, rather than from a few of dominant proportions, hence no Louisiana field was among the leading 25 in the country in output in 1943. Generally conservative production practices, guided by State law, foster stability in rates of production and long life of the fields.

Production of crude petroleum in Louisiana, 1939–43, by districts and fields

[Thousands of barrels]

District and field	1939	1940	1941	1942	1943[1]
Gulf Coast:					
Anse la Butte	24	380	1,446	2,235	2,191
Barataria	17	428	989	1,081	1,129
Bayou Sale	---------	---------	121	943	1,908
Black Bayou	1,048	1,007	838	895	1,101
Bosco	1,737	1,718	1,494	1,375	1,094
Caillou Island	4,078	2,493	2,002	1,519	1,829
Chacahoula	313	465	489	618	937
Chalkley	224	950	654	1,514	1,496
Charenton	2,425	2,724	1,849	1,380	1,116
Delta Farms	---------	21	151	309	1,013
Eola	943	3,935	3,668	3,313	3,137
Garden Island	591	1,106	1,225	1,256	1,357
Gibson	1,128	1,335	1,407	1,324	2,543
Golden Meadows	739	4,074	4,814	4,424	3,606
Grand Bay	496	1,168	2,022	2,010	2,522
Grand Lake	130	1,417	1,625	1,153	951
Gueydan	275	359	694	1,048	1,504
Hackberry	3,216	3,312	3,768	3,316	3,725
Iowa	4,436	3,475	3,400	2,506	2,928
Jennings	8,119	5,505	4,991	4,402	3,416
Lafitte	4,745	4,602	4,523	3,750	4,688
Lake Barre	347	317	219	178	165
Leeville	1,303	1,135	1,597	981	1,214
Neale	---------	319	834	884	1,333
New Iberia	4,204	3,076	2,760	2,287	2,606
North Crowley	827	1,602	2,004	1,803	1,699
Paradis	16	350	1,085	2,246	4,173
Pine Prairie	---------	---------	240	842	1,402
Port Barre	681	810	1,025	965	1,215
Quarantine Bay	901	1,585	2,311	2,107	2,567
Roanoke	1,076	965	851	612	600
St. Gabriel	---------	---------	554	1,345	1,732
Sulphur	1,381	970	921	700	801
Tepetate	2,033	1,656	1,481	1,000	912
University	1,444	3,496	3,591	3,289	2,896
Valentine	1,127	877	512	237	148
Venice	515	855	1,163	1,294	2,147
Ville Platte	3,352	4,493	6,119	6,446	4,450
White Castle	628	806	922	907	1,271
Other Gulf Coast	13,724	[2] 15,392	[2] 20,558	[2] 17,981	[2] 20,672
Total Gulf Coast	68,243	79,178	90,917	86,475	96,194
Northern:					
Caddo	2,663	2,912	3,077	2,694	2,421
Cotton Valley	4,384	5,189	3,459	2,033	1,532
Haynesville	1,064	987	956	4,621	5,368
Homer	988	1,041	1,033	1,060	1,067
Lisbon	1,693	1,482	896	758	585
Nebo [3]	---------	54	974	3,424	3,668
Olla [4]	---------	942	4,641	6,107	4,852
Rodessa	9,042	6,859	5,212	4,100	3,462
Shreveport	1,840	1,555	1,011	923	777
Urania	974	869	832	778	739
Other Northern	2,755	[2] 2,516	[2] 2,900	[2] 2,812	[2] 2,927
Total Northern	25,403	24,406	24,991	29,310	27,398
Total Louisiana	93,646	103,584	115,908	115,785	123,592

[1] Subject to revision.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Includes Hemphill, Trout Creek, and Jena.
[4] Includes Little Creek and Summerville.

Michigan.—The reduced output of the important Reed City field, which reached a peak in 1942, was the chief cause of a decline in Michigan production from 21,754,000 barrels in 1942 to 20,768,000 in 1943. Reed City produced 38 percent of the State total despite a reduction of 1.3 million barrels compared with 1942.

Output of the active Kawkawlin field, Bay County, gained 200,000 barrels in 1943, and several of the 1942 discoveries became larger factors in production as development proceeded. Notable among these were the Fork field, Mecosta County; Evart, Osceola County, and Prosper, Missaukee County.

Oil-well completions declined from 293 in 1942 to 235 in 1943, influenced by the Reed City development, where 52 fewer wells were drilled. The most active fields were: Fork with 33 wells, Kawkawlin 32, Goodwell 18, Bangor 17, and Prosper 12.

Of six discoveries in 1943 the Goodwell field, Newago County, was the most important, though relatively small. It produced 281,000 barrels from 18 wells in the Traverse limestone. Other small Traverse fields opened in 1943 were at Woodville, Newago County; Rose Lake, Osceola County; Breedville, Van Buren County; and Fillmore, Allegan County. Dundee oil was found in the Hatton field, Clare County, where two large wells and three dry holes were drilled. One well on the southwest flank of the Rose Lake (Traverse) field was reported to have found oil in the Dundee.

Core drilling of shallow holes, a common method of determining structural conditions below the glacial drift blanket in Michigan, was more active in 1943. In the southeastern counties several tests of the hitherto unexplored Cambrian formations were planned for 1944. A second deep test of the Salina was started in the Kawkawlin field near a well that found high-pressure gas and condensate in that formation in 1942.

Production of crude petroleum in Michigan, 1939–43, by fields[1]

[Thousands of barrels]

Year	Adams	Bloomingdale	Buckeye	Headquarters	Kawkawlin	Porter	Redding	Reed City	Walker	Winterfield	Other fields	Total
1939	54	3,371	2,502	-------	19	1,331	3,083	-------	2,821	-------	10,281	23,462
1940	313	1,001	1,004	-------	16	1,234	3,986	2	4,218	8	7,971	19,753
1941	1,118	529	665	315	185	1,136	1,749	2,754	1,292	1,101	5,515	16,359
1942	1,030	283	496	2,321	402	891	740	9,102	681	1,259	4,459	21,754
1943	984	167	442	1,999	689	742	423	7,847	453	683	6,339	20,768

[1] Data from Department of Conservation, Michigan.

Mississippi.—Production declined from 28,833,000 barrels in 1942 to 18,807,000 in 1943 as the Tinsley field passed its flush production peak in April 1942 and declined 50 percent in rate of output by the fourth quarter of 1943. Tinsley produced 98 percent of the State total in 1942 and 92 percent in 1943. The Vaughan-Pickens output was about 1 million barrels larger in 1943 than in 1942, and small amounts of oil were obtained from newly discovered fields.

Oil-well completions increased to 31 in 1943 compared with 20 in 1942. Active wildcatting resulted in opening four new oil fields. Two of these—Eucutta, Wayne County, and Brookhaven, Lincoln County—found oil in the Tuscaloosa formation; and Cranfield, Adams County, produced from the Wilcox. At Flora, Madison County, not far from the Tinsley field, a small well was completed in the Woodruff sand. Southwest of Natchez in Adams County oil from the Tuscaloosa was reported at a depth of 10,440 feet.

Events of early 1944 have indicated that the most important development of 1943 was the finding of oil in the Eutaw formation near the town of Heidelberg, Jasper County. The well tested deeper horizons and was not completed until after the year end, but it proved to be the discovery well of the second major oil reserve in Mississippi.

Production of crude petroleum in Mississippi, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939									5	17	32	53	107
1940	117	189	235	231	252	317	276	578	761	480	448	516	4, 400
1941	551	603	570	770	901	858	1, 425	1, 598	1, 694	1, 932	2, 240	2, 185	15, 327
1942	2, 489	2, 601	2, 708	2, 885	2, 648	2, 531	2, 469	2, 366	2, 194	2, 126	1, 953	1, 863	28, 833
1943 [1]	1, 766	1, 589	1, 639	1, 679	1, 655	1, 612	1, 585	1, 574	1, 470	1, 438	1, 408	1, 392	18, 807

[1] Subject to revision.

Montana.—Lower production at Cut Bank and Kevin-Sunburst in 1943 reduced Montana production to 7,916,000 barrels from 8,074,000 in 1942. Aside from these two fields, the only major change in recent years in Montana output was in that portion of the Elk Basin field north of the Wyoming State line, where an increase of over 200,000 barrels of black oil was reported in 1943. Since 1941 the demand for Montana oil has increased materially, in particular from Canadian sources and Washington State. The Alaskan highway is expected to have an important influence on the petroleum situation in this region after the war. Wildcatting was very active in 1943, but only three small oil fields were found: Gage, Musselshell County; East Utopia, Liberty County; and Brady, Pondera County. Oil-well completions increased from 123 in 1942 to 148 in 1943, but average initial production declined from 109 barrels to 91. Cut Bank had 74 new wells averaging 127 barrels each and Kevin-Sunburst 69 wells with a 56-barrel average. The Cut Bank field was extended to the south and Kevin-Sunburst to the west and northwest.

Production of crude petroleum in Montana, 1939–43, by fields

[Thousands of barrels]

Year	Cat Creek	Cut Bank	Dry Creek	Elk Basin	Frannie	Kevin-Sunburst	Lake Basin	Pondera	Other fields	Total
1939	196	3, 545	319	14		1. 576	18	276	16	5, 960
1940	187	4, 091	175	16	5	1, 923	18	305	8	6, 728
1941	173	5, 020	170	17	26	1, 753	17	286	[1] 64	7, 526
1942	138	5, 509	110	16	21	1, 992	13	264	[1] 11	8, 074
1943 [2]	120	5, 328	97	243	14	1, 840	16	211	[1] 47	7, 916

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

[2] Subject to revision.

Nebraska.—Declining output of three of the four producing fields caused a 50-percent shrinkage in Nebraska production in 1943 to 635,000 barrels, of which Falls City supplied about 67 percent and Barada 31 percent. The small Dawson production was raised by the output of six new wells. A single producer in the Falls City field completed the list of new wells in 1943.

Wildcatting was active, particularly in the central Nebraska basin, but results were disappointing, as no commercial production was found. The greatest interest was in Buffalo, Harlan, and Furnas Counties.

Production of crude petroleum in Nebraska, 1939–43, by months

[Thousands of barrels]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939											1	1	2
1940	3	2			3	8	7	7	8	65	90	83	276
1941	123	101	113	132	131	134	160	193	216	221	205	169	1,898
1942	115	117	122	118	116	113	104	99	90	87	78	78	1,237
1943 [1]	66	61	71	62	62	56	52	52	49	37	36	31	635

[1] Subject to revision.

New Mexico.—After the cut-back in production in 1942 to 31,544,000 barrels, occasioned by war-induced transportation difficulties, the output of New Mexico recovered in 1943 to 38,411,000 barrels as more adequate facilities for moving the oil to market became available. The flow of oil increased from all important fields except Loco Hills; the largest gains were at Vacuum and Eunice. Almost 33 million barrels came from Lea County fields and 5.2 million from Eddy County. In the northwest the largest producing field is the Hospah dome, where 1943 output was about 300,000 barrels.

Drilling declined in 1943 for the second year; only 182 oil-well completions were reported—69 less than in 1942. The most active fields, in order, were: Grayburg-Jackson, Maljamar, and Square Lake, all of which were materially extended.

Four discoveries were reported. The San Simon field, Lea County, which produced from the San Andres limestone, was perhaps the most important. In Eddy County three small pools were opened as follows: Benson, producing asphaltic oil from Yates limestone at 1,830 feet; Turkey Track, producing from Queen and Greyburg at 2,700 feet; and Fenton, with production from the Delaware sand at 2,650 feet.

One well was drilled in Lea County to a depth of 9,594 feet, and two other deep tests were drilling with the hope of extending production from the Ellenburger limestone from Winkler County, Tex., into southeast New Mexico.

Production of crude petroleum in New Mexico, 1939–43, by districts and fields [1]

[Thousands of barrels]

Year	Arrowhead	Eunice	Grayburg-Jackson	Hobbs	Loco Hills	Maljamar and South	Monument	Vacuum	Other Southeast	Northwest	Total
1939	[2]	7,863	1,509	4,401	377	330	8,206	3,028	11,651	303	37,668
1940	916	6,561	1,773	3,785	1,959	760	6,887	4,738	11,124	254	38,757
1941	1,429	6,658	1,627	3,686	2,308	1,651	6,960	4,800	10,335	206	39,660
1942	1,195	5,242	1,566	2,928	1,583	1,740	6,698	3,443	8,317	280	32,992
1943 [3]	1,703	6,498	1,914	3,780	1,296	1,853	7,190	4,953	9,312	425	38,924

[1] Oil and Gas Journal.

[2] Included under "Other Southeast."

[3] Subject to revision.

New York.—Production, which in 1942 attained a record of 5,421,000 barrels, under water-flood methods, declined to 5,059,000 in 1943. Although, according to the Oil Weekly, oil-well completions increased from 711 in 1942 to 781 in 1943, water-input well completions declined from 502 to 442, indicating that development of new flood acreage has slowed down.

Rising costs and a fixed price ceiling of $3.00 per barrel for Pennsylvania-Grade oil probably explain the lack of an aggressive production program.

Production of crude petroleum in New York, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	402	363	418	406	439	435	416	441	434	448	453	443	5, 098
1940	458	430	438	444	439	402	425	396	383	408	379	397	4, 999
1941	424	372	410	436	435	422	456	438	445	465	414	468	5, 185
1942	453	405	454	458	455	467	474	456	459	461	425	454	5, 421
1943 [1]	418	389	453	427	432	436	438	429	423	403	401	410	5, 059

[1] Subject to revision.

Ohio.—The decline in production from 3,543,000 barrels in 1942 to 3,322,000 in 1943 resulted chiefly from a sharp reduction in the output of Corning-Grade oil. Operators are inclined to regard the ceiling price of $1.31 per barrel for this oil as too low to stimulate development. The production of Pennsylvania-Grade oil, however, increased from 1,637,000 barrels to 1,719,000 barrels, influenced by flush production from the Clayton pool.

Oil-well completions were 152 in 1943 compared with 235 in 1942, according to the Oil Weekly. Perry was again the most active county, with 55 oil wells completed, of which 33 were in the prolific Clayton (Clinton-sand) pool. Perhaps the largest Clinton-sand well ever drilled in Ohio was completed in Falls Township, Muskingum County, with an initial daily production of 550 barrels. Offset wells, however, were disappointing. In Blue Rock Township of the same county an Oriskany-sand oil well yielded 40 barrels initially. Several deep tests of the Clinton (below 4,500 feet) were unproductive, as was a well in Olive Township, Meigs County, that reached the Trenton limestone at a depth of 6,884 feet and was drilled to a total depth of 7,466 feet.

Production of crude petroleum in Ohio, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	252	236	274	255	288	272	269	266	247	276	260	261	3, 156
1940	207	234	246	264	280	260	286	287	272	296	248	279	3, 159
1941	278	255	273	294	300	297	298	286	300	316	289	324	3, 510
1942	277	262	296	317	297	322	319	297	300	308	280	268	3, 543
1943 [1]	253	244	293	273	278	285	286	303	278	274	276	279	3, 322

[1] Subject to revision.

Oklahoma.—The decline in production that began in 1938 continued in 1943, when total output was 123,152,000 barrels, a reduction of 17.5 million barrels (12 percent) from 1942. Declines in Oklahoma City and the Seminole district, which produced 26,484,000 and 16,599,000 barrels, respectively, in 1943 totaled 10 million barrels or 57 percent of the State's total decline. Since 1937 almost half of the total decline in production has been in these two leading areas. Oklahoma was replaced by Louisiana in 1943 as the third largest producing State.

Fields showing the largest gains in output in 1943 were: Pauls Valley 1.1 million barrels, Cumberland 1.0 million, and Apache 0.6 million. Material declines were reported from the Nowata County water-flood fields, in common with other such areas in the country, and from Hewitt, Cement, Cromwell, and Fitts fields.

Oil-well completions numbered 543 in 1943, 19 more than in 1942. The most active fields were Pauls Valley (40 new oil wells), where spacing requirements were relaxed from 40 to 20 acres; Loco (38); Cumberland (26); Velma (19), stimulated by discovery of oil in the Simpson zone; Cement (16); West Edmond (11); and Wewoka (10).

Among 33 discoveries, the largest reserves were indicated at West Edmond, Oklahoma County, where 11 large wells produced from the Hunton limestone at a depth of almost 7,000 feet, and active development continued in 1944. The discovery of heavy production in the second Wilcox sand at West Moore, Cleveland County, may ultimately prove to be even more significant. These two fields are on the west flank of the great Nemaha granite ridge and have caused intensive investigation over a wide area. Relatively important discoveries were made at Big Bend, Osage County (Layton-sand production); West Burnett, Pottawatomie County (Second Wilcox sand); North McLoud, Lincoln County (Wilcox sand); and Horn's Corner, Hughes County (Cromwell sand). The findings of production from the granite wash in a deep well at West Sentinal, Washita County, is expected to encourage exploration in that region to depths of over 10,000 feet.

The opening of Madrano-sand production in the Cement field added important oil reserves from which over 400,000 barrels were produced in 1943 from 13 wells. In the Cumberland field a new productive formation, the Oil Creek, adds to the potentialities of that area.

Although some water-flood operations were expanded in the Rogers, Nowata, and Wagoner Counties district, no new projects of thsi character were reported.

Production of crude petroleum in Oklahoma, 1939–43, by fields [1]

[Thousands of barrels]

Field	1939	1940	1941	1942	1943
Allen	2,289	2,066	1,780	1,365	1,245
Apache	------	------	274	1,740	2,309
Beebe	1,005	1,828	1,526	1,152	1,057
Billings	2,178	2,209	2,276	2,064	1,706
Bristow-Slick	2,403	2,213	1,951	1,777	1,658
Burbank	2,689	2,838	3,282	3,356	3,251
Cement	1,826	2,469	3,354	3,211	2,564
Coyle	386	637	1,468	1,660	1,627
Crescent	983	769	576	752	752
Cromwell	1,175	1,357	1,457	2,380	1,761
Cumberland	------	393	2,543	2,776	3,735
Cushing-Shamrock	3,446	3,353	3,223	3,069	2,991
Dill	358	635	1,426	548	336
Edmond	1,675	1,488	1,224	1,136	1,161
Fish	1,376	1,153	1,359	923	700
Fitts	9,120	6,246	4,223	3,050	2,489
Healdton	3,236	3,177	3,086	2,827	2,618
Hewitt	1,362	1,778	4,860	3,304	2,382
Keokuk	1,176	1,091	1,029	1,012	678
Lucien	3,017	2,750	2,067	1,877	1,575
Nowata County	4,348	4,306	3,995	3,787	3,039
Oklahoma City	35,728	35,970	32,184	26,484	20,338
Olympic	1,034	739	598	490	419
Osage (outside Burbank-South Burbank)	6,063	5,904	6,131	4,716	4,918
Pauls Valley	------	------	------	823	1,963
Ramsey	1,489	1,377	1,549	1,664	1,590

Production of crude petroleum in Oklahoma, 1939–43, by fields[1]—Continued

[Thousands of barrels]

Field	1939	1940	1941	1942	1943
Seminole field:					
Bowlegs	2,678	2,464	2,134	1,900	1,721
Carr City	922	840	791	662	602
Earlsboro	3,590	3,730	3,757	3,718	3,253
Konawa	656	766	1,245	670	521
Little River	2,865	2,875	2,705	2,333	1,931
St. Louis-Pearson	11,303	9,331	6,997	5,687	3,828
Seminole City	2,618	2,501	2,243	2,854	2,555
Other Seminole districts	5,310	4,482	3,815	2,584	2,188
Total Seminole field	29,942	26,989	23,687	20,408	16,599
Sholem-Alechem-Tatums-Tussy	1,699	2,169	2,826	2,490	2,275
South Burbank	3,150	2,927	2,780	2,728	2,637
Other fields	30,331	31,936	36,523	33,192	30,186
Total Oklahoma	153,484	150,767	153,257	136,761	120,559

[1] Oil and Gas Journal.

Pennsylvania.—Production fell sharply in 1943 (11 percent) to 15,757,000 barrels, and a declining daily rate persisted from mid-1942 through 1943. Almost all of the decline is attributable to the Bradford field, where operations were substantially reduced, owing in part to dissatisfaction of the operators with the static ceiling price of $3.00 per barrel for Pennsylvania-Grade oil in the face of rising costs of production by secondary recovery methods. The decline in stocks of oil of Pennsylvania origin during the year from 1,655,000 barrels to the critically low level of 1,364,000 was accompanied by curtailment in deliveries below contract requirements.

Oil-well completions declined from 1,802 in 1942 to 1,122 in 1943 and water-input wells from 1,620 to 1,104 according to the Oil Weekly. Only two small discoveries were reported—one in German Township, Fayette County (Speechley sand), and one in Cumberland Township, Greene County (Dunkard sand).

The experimental shaft near Franklin was completed in 1943, and two horizontal bores were drilled from it through the oil sand. No information is available on the economic aspects of the venture, which has attracted wide interest.

Production of crude petroleum in Pennsylvania, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	1,316	1,255	1,437	1,411	1,558	1,437	1,405	1,479	1,414	1,570	1,532	1,538	17,382
1940	1,522	1,505	1,530	1,582	1,585	1,335	1,418	1,387	1,321	1,405	1,319	1,444	17,353
1941	1,416	1,231	1,336	1,382	1,407	1,345	1,419	1,376	1,440	1,501	1,370	1,527	16,750
1942	1,501	1,332	1,518	1,582	1,522	1,560	1,526	1,508	1,481	1,502	1,359	1,388	17,779
1943[1]	1,358	1,229	1,419	1,348	1,367	1,368	1,359	1,330	1,290	1,246	1,228	1,215	15,757

[1] Subject to revision.

Texas.—The gain in production from 483,097,000 barrels in 1942 to a new high of 593,520,000 barrels in 1943 represented 95 percent of the total increase in United States production. Texas produced 34.8 percent of our total domestic supply of petroleum in 1942 and 39.5 percent in 1943. The Gulf coast became the largest producing district in 1943, owing to an outstanding increase of 65.1 million barrels over 1942. All other districts raised their output, led by East Texas (19.5 million barrels) and West Texas (16.8 million).

Oil-well completions declined further in 1943 to only 2,373, or less than one-third of the 1941 total. A notable increase in the number of dry holes from 1,461 in 1942 to 1,908 in 1943, despite a general decline in drilling, was indicative of greater exploratory effort, particularly in North, Central, and South Texas. Fewer new oil wells were reported in all districts except North Texas, with greatest reductions in West and Gulf Coast Texas.

The large increase in Gulf Coast production resulted from increased well allowables rather than from new development. The leading fields, in order of production (all over 6 years old), were: Conroe, Hastings, Friendswood, Thompson, and Anahuac. Each showed an outstanding increase in 1943 output—from 4.6 to 7.8 million barrels.

The most actively developed fields were: Stowell (24 oil-well completions), Mercy (23), North La Ward (23), and West Ranch (13). Important new reserves were developed at Stowell, whose unusual situation on the upthrown side of a fault is expected to influence future exploration. Extensions or new producing sands were developed at Mercy, Mayo, Boling Dome, Humble Dome, Double Bayou, and other fields.

Among the discoveries, perhaps the most important was at North Katy in Harris-Waller Counties, where large oil reserves were indicated in Cockfield-Yegua sand about 2 miles north of the gas-condensate producing area; and at Kirby, Liberty County, where Yegua oil was found on the southwest flank of the Esperson dome. Condensate reservoirs were opened at Chesterville, Colorado County, and Jackson Pasture, Chambers County.

In South Texas wildcatting was active, particularly in the Rio Grande Valley, and a number of discoveries were reported. Promising Wilcox pools were found at Slick, Goliad County (12 wells), and at Hobson, Karnes County. Frio-sand production was discovered in the Scott-Harper field, Brooks County. The large Willamar field, Willacy County, was extended north and south.

The rate of West Texas production was about 80 percent higher in the late months of 1943 than in January, reflecting urgent demand and enlarged outlets for the oil by pipe line and rail. One major line to the Gulf coast was reopened in 1943; and two, running east and northeast, that will add over 100,000 barrels per day to capacity in 1944, were approaching completion at the end of the year.

Drilling fell sharply for the second successive year, but the great excess productive capacity developed in prior years has been adequate to meet the new demands. The most extensive development in 1943 was in the Slaughter field (255 oil wells completed), Wasson (53), Mascho (38), North Cowden (27), and Fullerton (17). Extensive additions were made to the productive areas of all of these fields.

Production of crude petroleum in Texas, 1939–43, by districts and fields

[Thousands of barrels]

District and field	1939	1940	1941	1942	1943[1]
Gulf Coast:					
Agua Dulce	159	128	714	795	1,904
Amelia	951	894	1,220	1.375	1,668
Anahuac	2,604	2,683	4,657	3,589	8,906
Barbers Hill	3,165	3,180	3,076	2,879	2,340
Clear Lake	136	377	605	647	1.468
Conroe	9.320	9,303	11,630	13,514	19.967
Dickinson-Gillock	2,946	2,940	2,191	2,073	2,128
Fairbanks	2,668	2,460	2,932	2,784	2,802
Fannette	151	184	457	457	1,242
Flour Bluff	1,362	1,151	1,336	426	1.009
Friendswood	2,323	2,542	2,959	3,615	11,420
Goose Creek	619	571	509	484	388
Greta	1,993	1,493	2,357	1,132	1,499
Hardin	2.180	1,646	1,659	1,091	1,372
Hastings	6,354	5,421	7,623	10,412	17,964
Heyser	3,470	3,399	2,633	2,926	3,337
High Island	866	966	985	880	805
Hull	2,077	2,005	2,387	2,217	1,879
Humble	1,041	957	913	809	796
Lolita	----------	215	1,454	2,269	1.887
Lovell's Lake	245	882	1,334	1,784	2,040
Luby	2,472	1,459	1,396	782	1,276
Manvel	2,718	2,627	1,915	1,906	2,665
Old Ocean	3,209	4.165	4,741	3,701	4,785
Pierce Junction	897	628	637	561	515
Placedo	2,298	1,882	1,401	1,228	1,730
Raccoon Bend	1.034	1,232	1,329	1.587	2,646
Refugio	2,097	2,111	2,223	1,542	1,509
Saxet-Saxet Heights	8,953	5,634	4,578	2,728	2,677
Segno	958	1,606	1,538	1,290	1,599
South Houston	951	638	788	667	1,586
Spindletop	782	609	486	419	375
Sugarland	1,242	1,351	647	614	1,779
Thompsons	4,617	4,384	4,609	5.392	9,993
Tomball	2,630	2,675	3.314	3,146	3,257
West Beaumont	1,033	1,149	821	738	724
West Columbia	2,261	2,353	2,740	1,984	2,041
West Ranch	280	1,862	3,691	5,249	6.762
White Point	2,089	3.054	2,864	2,934	3,905
Withers-Magnet	1,330	1.712	2,829	4,165	6,015
Other Gulf Coast	36,042	[2] 37,635	[2] 38,554	[2] 38,229	[2] 57,468
Total Gulf Coast	122,523	122,166	134,732	135,020	200,128
East Texas:					
East Texas proper[3]	144,615	141.023	132,486	122.799	129.983
Cayuga	3,472	4,432	4,303	4,066	3,459
Chapel Hill	----------	231	480	979	1,293
Hawkins	----------	----------	1,432	5,451	14,243
Long Lake	867	828	1,342	1,463	1,558
Rodessa	9,785	6,607	4,712	3,166	2,821
Sulphur Bluff	1,536	1,522	1,582	1.549	1,510
Talco	9,609	8,818	9,038	9.522	9,266
Van	5.333	4,512	3.739	3,444	6,411
Other East Texas	738	946	846	843	2,281
Total East Texas	175,955	168,919	159,960	153,282	172.825
Central Texas:					
Darst Creek	2,707	2,178	1,845	2,220	2,779
Luling	2,443	2,256	1,974	1,754	1,645
Mexia-Powell[4]	1,494	1,418	1,531	1.480	1,339
Salt Flat (Bruner)	1,594	1,512	1,348	1,118	909
Other Central Texas	3,431	3,064	2,897	1,954	2,760
Total Central Texas	11,669	10,428	9,595	8,526	9,432
North Texas[5]	40,371	[6] 48.153	[6] 48,529	[6] 49,932	[6] 50,015
Panhandle[7]	24,165	26,716	27,831	30.881	33,295
South Texas[8]	29.302	32,333	32,018	23,681	29,285
West Texas:					
Andrews County	1,587	1,506	2,224	1.345	2,008
Big Lake	2,275	2,075	1,938	1,839	1,762
Crane-Upton	9,562	10.389	9.920	9,628	11.598
Crocket	464	574	827	919	1,187
Ector[9]	18,618	20,142	23.486	16.132	20,303
Fisher	1,059	835	655	572	476

See footnotes at end of table.

Production of crude petroleum in Texas, 1943–43, by districts and fields—Continued

[Thousands of barrels]

District and field	1939	1940	1941	1942	1943 [1]
West Texas—Continued.					
Gaines-Yoakum	6, 081	12, 066	15, 731	11, 530	15, 785
Glasscock-Howard-Mitchell	8, 133	7, 862	7, 202	7, 165	7, 008
Pecos	10, 651	9, 593	8, 391	9, 808	12, 288
Slaughter	416	841	4, 612	7, 403	11, 267
Ward	7, 795	7, 580	7, 189	5, 890	5, 734
Winkler	12, 051	10, 324	9, 962	8, 690	8, 921
Other West Texas	761	707	770	854	204
Total West Texas	79, 453	84, 494	92, 907	81, 775	98, 540
Total Texas	483, 528	493, 209	505, 572	483, 097	593, 520

[1] Subject to revision.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Joiner, Kilgore, Lathrop, and other pools in Cherokee, Gregg, Rusk, Smith, and Upshur Counties.
[4] Includes other fields in Falls, Freestone, Limestone, and Navarro Counties.
[5] Includes the fields in and between Wilbarger, Wichita, Clay, Montague, and Cooke Counties on the north and Runnels, Coleman, Brown, and Comanche Counties on the south.
[6] Includes crude oil consumed on leases and net change in stocks held on leases for East (exclusive of East Texas proper), Central, North, and South Texas.
[7] Carson, Gray, Hutchinson, Moore, and Wheeler Counties.
[8] Includes fields in Brooks, Duval, Hidalgo, Jim Hogg, Jim Wells, LaSalle, Live Oak, McMullen, Starr, Webb, and Zapata Counties.
[9] Includes the part of Jordan pool in Crane County.

The most significant new production was discovered in the Ellenburger (Ordovician) limestone at depths below 9,200 feet in the Kermit, Keystone, and Wheeler fields in Winkler County. Although the potentialities are great, development must be comparatively slow because of the difficulty and cost of drilling. Much exploration of deep strata from the base of the Permian down to the Ordovician is projected over a wide area. Twelve Permian discoveries were reported in seven counties; three were in Andrews, three in Pecos, and two in Howard.

Output of the East Texas district in 1943 was 13 percent higher than in 1942, owing to gains in the East Texas field (7.2 million barrels), Hawkins (8.8 million), and Van (3.0 million). The East Texas field reservoir pressure dropped only about 8.3 pounds during 1943, as it was supported by the return of about 300,000 barrels per day of salt water to the Woodbine sand. The output of 14.2 million barrels at Hawkins raised this field to thirteenth position among the leading producing fields of the country.

Although oil-well completions in 1943 (157) were below those of 1942 (239) in the East Texas district, the rate of drilling increased progressively during the year. In the most active fields—Quitman (54 new oil wells), Hawkins (33), and Kildare (28)—significant additions to proved reserves were made. Quitman and Kildare (1942 discoveries) developed into important fields in 1943.

Five oil and two condensate fields were discovered in 1943. New Hope in Franklin County is regarded as a possible major field, with production from the Rodessa and Travis Peak formations and two other productive sands indicated. The Paluxy production, found in the Manziel field, Wood County, from eight wells before the end of the year, also may attain important proportions. Other new oil fields were reported in Grayson, Hunt, and Rusk Counties. The condensate fields were at Appleby, Nacogdoches County, and Stewards Mill, Freestone County.

Production in North and Central Texas in 1943 was moderately higher than in 1942, in response to growing demand for high-gravity crude from the Mid-Continent refiners. The most active fields were: Walnut Bend (25 wells), Electra (18), K. M. A. (16), and Hildreth (13). Wildcatting resulted in a number of relatively small discoveries in formations of the Bend and Strawn series and a few in Mississippian and Ordovician (Ellenburger) rocks. Most of the discoveries were in Clay and adjacent counties; the Hildreth field in western Montague, producing from the Bend conglomerate, appeared to be the most important.

The Panhandle produced 33,295,000 barrels in 1943, an increase of 8 percent over 1942. Only 148 oil wells were completed, 110 less than in 1942 and 500 less than in 1941. The most active counties were Hutchinson (86 oil wells), Gray (47), and Carson (13).

West Virginia.—Production decreased 6 percent in 1943 to 3,349,000 barrels in the absence of stimulating influences from new discoveries or an increased price for oil. A relatively high (and rising) production cost in West Virginia is dictated by the low average rate of production per well—only about one-half barrel per day.

Oil well completions declined from 126 in 1942 to 88 in 1943, with an average initial daily production of 19 and 8 barrels per well, respectively. The most active counties, according to David B. Reger, Morgantown, W. Va., were: Wood with 15 completions, 8 of which were in the Ogdin field; Calhoun 12 completions, 9 of which were in the Sycamore field; and Clay 9.

Production of crude petroleum in West Virginia, 1939–43, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1939	279	282	312	288	320	309	288	310	290	309	282	311	3,580
1940	234	301	285	300	311	276	303	291	286	312	264	281	3,444
1941	286	249	276	300	290	280	297	283	289	311	270	302	3,433
1942	294	267	310	313	297	306	306	305	310	321	267	278	3,574
1943 [1]	296	261	295	285	272	298	281	278	274	278	264	267	3,349

[1] Subject to revision.

Wyoming.—Continuing the steady increase of recent years, Wyoming produced 33,077,000 barrels in 1943, 1 percent more than in 1942. The greatest gain, at Elk Basin, reflected development of important production from the Tensleep sand, opened in December 1942. Other large gains were reported from Oregon Basin and Byron-Garland. Lance Creek, Lost Soldier, and Salt Creek declined, the last being displaced by Oregon Basin as the second largest producing field in the State.

Completion of 102 oil wells, with average initial production of 657 barrels, was reported in 1943 compared with 93 with 317 barrels in 1942. The higher per-well average in 1943 was caused by 22 wells in the new Elk Basin development, which averaged 2,147 barrels each. Oregon Basin was the most active field, with 26 new wells averaging about 300 barrels.

Two important discoveries were made—at Steamboat Butte, Fremont County, production was found in the Sundance and upper sands; and on the Gebo dome, Hot Springs County, a large well was completed in thick Embar sand. In Park County small fields producing from the Madison formation were opened at Frannie and Oregon Basin. From the standpoint of added reserves, the Elk Basin Tensleep sand exploitation overshadowed other activities, with indications of over 200 million barrels, according to early estimates. The Embar productive area at Oregon Basin also was materially enlarged.

Production of crude petroleum in Wyoming, 1939–43, by fields

[Thousands of barrels]

Year	Big Muddy	Byron-Garland	Cole Creek	Elk Basin	Frannie	Grass Creek	Hamilton Dome-Warm Springs	La Barge	Lance Creek	Lander-Dallas-Derby Dome
1939	435	867	24	203	496	844	240	379	6,884	278
1940	429	1,411	65	190	812	718	353	585	9,121	290
1941	421	1,516	295	195	939	1,171	264	767	8,838	309
1942	402	2,163	372	156	1,013	1,524	445	767	7,857	294
1943 [1]	382	2,554	414	2,133	846	1,313	508	655	7,082	280

Year	Lost Soldier-Ferris-Wertz	Medicine Bow	Oregon Basin	Osage	Poison Spider-South Casper	Quealy	Rock Creek	Salt Creek	Other fields	Total
1939	1,592	544	1,848	132	26	225	1,008	5,331	98	21.454
1940	2,070	251	2,725	59	238	172	928	5,201	[2] 93	25,711
1941	4,745	245	3,197	132	251	158	952	5,146	[2] 337	29,878
1942	5,118	231	4,711	114	236	170	933	5.004	[2] 1,302	32.812
1943 [1]	4,246	229	5.345	102	262	154	911	4,820	[2] 841	33,077

[1] Subject to revision.

[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

WELLS

The number of wells drilled in the United States in 1943, including oil and gas wells and dry holes, continued to decline, dropping from 29,070 in 1941 to 18,151 in 1942 and to 17,884 in 1943.

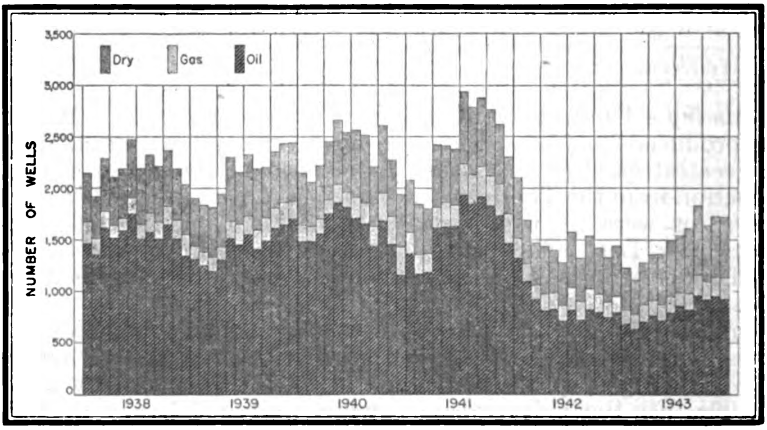

FIGURE 4.—Wells drilled in the United States, 1938-43, by months.

Oil-well completions fell from 10,524 in 1942 to 9,717 in 1943; the number of gas wells completed decreased from 2,089 in 1942 to 1,897 in 1943; and the number of dry holes rose from 5,538 in 1942 to 6,270 in 1943.

The total number of wells drilled during the first half of 1943 was substantially below the same period in 1942, but in the latter half of 1943 the relative number of wells drilled increased materially. The necessity for expanding crude production to record levels has caused much concern over the maintenance of adequate reserves and has stimulated the program to expand the drilling of exploratory wells.

The oil shortage in the Pacific Coast area resulted in an active drilling campaign in California, where the total wells drilled rose from 829 in 1942 to 1,447 in 1943. The number of oil-well completions increased by 603 over 1942. The number of wells drilled in Kentucky rose from 260 in 1942 to 656 in 1943—an increase of 396. This drilling resulted in the completion of 243 oil wells in 1943 compared with only 59 completions in 1942. Kansas ranked third among the States in the increase in the total number of wells drilled, with a gain of 216 wells. The total number of wells drilled in Texas declined from 4,688 in 1942 to 4,421 in 1943, and the number of oil-well completions decreased from 3,041 in 1942 to 2,373 in 1943. The number of wells drilled in Pennsylvania, New York, Ohio, and West Virginia decreased from 4,717 in 1942 to 4,045 in 1943, and the number of oil wells completed fell from 2,757 in 1942 to 2,194 in 1943.

Wells drilled for oil and gas in the United States, 1942–43, by months [1]

Wells	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Percent
1942														
Oil	1,320	1,099	922	823	843	723	828	742	830	827	764	803	10,524	58.0
Gas	220	171	144	162	150	157	221	180	203	172	152	157	2,089	11.5
Dry	569	422	405	461	425	426	521	421	506	450	437	495	5,538	30.5
	2,109	1,692	1,471	1,446	1,418	1,306	1,570	1,343	1,539	1,449	1,353	1,455	18,151	100.0
1943														
Oil	683	635	701	764	717	793	853	824	954	919	952	922	9,717	54.3
Gas	119	126	155	134	141	160	144	160	195	176	183	204	1,897	10.6
Dry	418	351	434	457	499	539	554	625	675	538	588	592	6,270	35.1
	1,220	1,112	1,290	1,355	1,357	1,492	1,551	1,609	1,824	1,633	1,723	1,718	17,884	100.0

[1] Oil and Gas Journal east of California; American Petroleum Institute in California.

Wells drilled in the United States, 1942–43, by States and districts [1]

State and district	1942				1943			
	Oil	Gas	Dry	Total	Oil	Gas	Dry	Total
Arkansas	103	7	74	184	137	8	103	243
California [2]	557	25	247	829	1,150	30	267	1,447
Colorado and Utah	10	1	14	25	11	1	19	31
Illinois	1,169	14	846	2,029	1,046	12	693	1,751
Indiana	141	26	220	387	96	11	140	247
Kansas	815	80	624	1,519	880	36	819	1,735
Kentucky	59	148	53	260	243	162	251	656
Louisiana:								
Gulf Coast	286	6	142	434	210	13	137	360
Northern	272	20	153	445	126	59	128	313
Total, Louisiana	558	26	295	879	336	72	265	673
Michigan	293	70	300	663	235	47	346	628
Mississippi	20		51	71	31		84	115
Montana	123	69	26	218	148	27	65	240
Nebraska	10		27	37	7		35	42
New Mexico	251	12	83	346	182	7	62	251
Oklahoma	524	86	549	1,159	543	92	549	1,184
Pennsylvania, New York, Ohio, and West Virginia	2,757	1,333	627	4,717	2,194	1,250	601	4,045
Texas:								
Gulf Coast	437	38	190	674	245	24	244	513
East Texas	239	16	148	403	157	14	139	310
West Texas	1,065	10	180	1,255	717	6	168	891
Rest of State	1,300	122	934	2,356	1,254	96	1,357	2,707
Total, Texas	3,041	186	1,461	4,688	2,373	140	1,908	4,421
Wyoming	93	6	20	119	102	6	25	133
Other States			21	21	3	1	38	42
Total, United States	10,524	2,089	5,538	18,151	9,717	1,897	6,270	17,884

[1] Oil and Gas Journal, except California. [2] American Petroleum Institute.

Producing oil wells in the United States and average production per day in 1942, by States and districts [1]

State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)	State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)
Arkansas	3,100	24.0	**New York**	21,000	0.7
California [2]	18,550	38.6	Ohio	23,900	.4
Colorado	210	29.4	Oklahoma	53,000	7.2
Illinois	24,100	12.6	Pennsylvania	83,500	.6
Indiana	1,900	10.1			
Kansas	23,300	11.5	Texas:		
Kentucky	15,000	.8	Gulf Coast	12,600	29.5
			East Texas proper	25,100	13.2
Louisiana:			West Texas	15,300	15.1
Gulf Coast	3,050	83.9	Rest of State	46,800	8.3
Northern	3,900	20.6			
			Total, Texas	99,800	13.2
Total, Louisiana	6,950	47.2	West Virginia	17,100	.6
Michigan	3,320	18.4	Wyoming	3,650	25.3
Mississippi	350	232.3	Other States [3]	110	1.0
Montana	2,050	11.1			
Nebraska	90	42.4	Total wells	404,840	9.4
New Mexico	3,860	23.1			

[1] Figures for 1943 not yet available.
[2] American Petroleum Institute.
[3] Missouri and Tennessee.

STOCKS

Total crude-oil stocks increased about 6 million barrels in 1943 compared with a decline of 12 million in 1942. An increase of over 7 million barrels in the first quarter was due to transportation problems and to the relative low rate of demand for all oils, resulting from the curtailment of civilian consumption and the fact that war requirements had not begun the rapid rise that characterized later quarters of the year. During the second quarter of 1943, crude stocks declined by about 2 million barrels, but stocks of refined oils were depleted by over 11 million barrels owing primarily to the sharp rise in the military demand for gasoline. Although crude production and runs to stills increased rapidly, the supply of all oils was inadequate to meet the gain in total demand. In the third quarter, stocks of crude petroleum declined by almost 6 million barrels, in spite of a further gain in crude production and imports. With improvement in transportation facilities, the major problem became one of an adequate supply of crude petroleum from domestic sources. Every effort was made to increase crude production to record levels, and crude stocks rose by about 6 million barrels during the last quarter of 1943. Total stocks of crude petroleum amounted to 251,795,000 barrels on December 31, 1943, compared with 245,754,000 barrels on December 31, 1942. Stocks of foreign crude increased over 1 million barrels during the year, and stocks of domestic origin rose by about 5 million barrels.

Stocks of crude petroleum, natural gasoline, and refined products in the United States at end of year, 1939–1943

[Thousands of barrels]

Product	1939	1940	1941	1942	1943[1]
Crude petroleum (refinable):					
At refineries	49,215	52,448	51,319	43,620	47,719
Pipe line and tank farm	178,810	200,726	183,992	177,904	181,422
Producers	11,953	11,535	12,188 [2] 11,573	13,365	14,365
Total refinable	239,978	264,709	247,499	234,889	243.506
California heavy crude	13,330	11,906	10,179	10,865	8,289
Total crude petroleum	253,308	276,615	257.678 [2] 257,063	245,754	251,795
Natural gasoline	4,421	5,704	4,275 [2] 4,437	4,632	4,541
Refined products[3]	268,109	282.265 [2] 280.958	290,375 [2] 294.310	247,554	229,362
Grand total	525,838	564,584 [2] 563,277	552.328 [2] 555,810	497,940	485,698

[1] Final figures.
[2] For comparison with succeeding years.
[3] Includes equivalents for wax, coke, and asphalt in barrels.

The data on stocks of crude oil, by States of origin, for 1943 show that the principal increases were 11.2 million barrels for Texas, 3.9 million for Illinois, 2.5 million for Louisiana, and 1.3 million for New Mexico. The largest declines in stocks by origin were 7.2 million barrels for Oklahoma, 4.2 million for all grades of California crude, and 2.4 million for Wyoming.

Stocks of crude petroleum in the United States in 1943 by States of location and by months [1]

[Thousands of barrels]

State	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
LOCATION													
Arkansas	1,590	2,256	2,574	2,526	2,450	2,513	2,585	2,674	2,904	2,849	2,898	2,988	2,991
California, Washington [2]	32,770	33,115	33,632	34,450	34,207	34,263	33,464	32,592	31,965	32,371	32,243	32,379	31,210
Colorado	637	581	531	571	542	546	493	480	483	411	431	495	456
Georgia, Florida, and South Carolina	11	3	------	------	------	------	22	78	89	80	132	113	77
Illinois, Minnesota, and Wisconsin	9,170	9,297	9,894	10,617	11,404	11,152	11,928	12,949	13,929	14,577	15,647	16,178	15,258
Indiana	3,203	3,409	3,446	3,690	3,821	4,210	4,006	3,975	3,574	3,581	3,658	3,863	3,795
Kansas and Nebraska	8,406	7,928	7,774	7,853	7,993	7,874	7,390	7,433	7,705	7,719	7,431	7,582	7,236
Kentucky and Tennessee	1,846	1,753	1,799	1,649	1,804	1,856	1,908	1,901	1,952	1,879	1,829	1,924	2,019
Louisiana and Alabama	9,071	9,139	10,283	12,150	13,461	14,502	14,435	13,803	13,623	13,301	13,829	14,523	15,154
Maryland	604	644	550	454	717	628	640	839	821	561	842	988	761
Massachusetts and Rhode Island	652	565	661	659	567	770	947	781	861	667	870	989	1,017
Michigan	1,237	1,229	1,245	1,358	1,300	1,341	1,347	1,545	1,395	1,358	1,401	1,464	1,399
Mississippi	264	319	286	277	353	367	376	316	283	276	351	316	280
Missouri and Iowa	4,109	4,077	4,399	4,382	4,452	4,699	4,788	4,644	4,642	4,455	4,585	4,610	4,811
Montana	698	683	720	804	943	898	865	857	844	785	843	911	931
New Jersey	2,628	2,810	2,848	2,620	2,579	2,663	3,484	3,271	3,528	3,118	3,611	3,247	3,262
New Mexico	1,374	1,365	1,415	1,344	1,364	1,366	1,259	1,456	1,220	1,550	1,342	1,250	1,450
New York	716	718	914	1,034	952	938	1,032	1,002	1,074	1,214	884	892	834
Ohio	6,131	6,722	7,181	7,905	7,904	7,044	7,274	7,909	7,304	6,805	6,656	6,338	6,909
Oklahoma	31,908	31,474	31,700	31,925	31,205	31,482	31,394	30,939	30,964	29,863	29,278	28,164	27,968
Pennsylvania	5,552	5,484	5,147	5,242	5,365	5,783	6,319	6,921	7,162	6,813	6,876	7,332	6,834
Texas	99,461	98,709	97,780	98,322	97,420	96,878	92,946	91,344	89,398	91,267	93,532	96,101	98,675
Utah	394	402	430	461	486	484	479	483	471	455	386	392	440
West Virginia	1,072	1,089	1,125	1,161	1,096	906	911	923	879	916	994	993	991
Wyoming and Idaho	11,385	11,187	11,276	11,262	11,084	11,252	10,844	10,709	10,550	9,951	9,437	9,247	8,748
Total United States	234,889	234,958	237,610	242,716	243,469	244,415	241,136	239,824	237,620	236,822	239,986	243,279	243,506
Heavy crude in California	10,865	10,804	10,394	10,402	9,674	9,748	10,064	10,279	10,009	8,905	8,716	8,170	8,289

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[1] Final figures.

[2] Heavy crude stocks in California given below.

Stocks of crude petroleum in the United States in 1943 by States of origin and by months [1]

[Thousands of barrels]

State	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
ORIGIN													
Arkansas	2, 516	2, 225	2, 366	2, 451	2, 337	2, 400	2, 629	3, 075	2, 877	2, 584	2, 861	2, 897	2, 973
California [2]	32, 757	33, 107	33, 616	34, 417	34, 174	34, 281	33, 426	32, 547	31, 931	32, 349	32, 201	32, 322	31, 158
Colorado	465	425	425	415	395	407	373	325	348	317	303	386	354
Florida	------	------	------	------	------	------	------	------	------	------	------	1	4
Illinois	9, 254	9, 371	10, 046	11, 169	10, 949	11, 169	12, 416	12, 079	11, 959	12, 017	12, 593	13, 210	13. 118
Indiana	248	264	239	217	221	235	237	204	195	156	133	137	191
Kansas, Nebraska	7, 062	7, 600	8, 152	8, 456	8, 898	8, 684	8, 412	8, 359	8, 051	7, 957	7, 724	7, 687	7, 547
Kentucky	1, 162	1, 120	1, 007	1, 085	1, 138	1, 113	1, 144	1, 081	1, 212	1, 144	1, 115	1, 220	1, 270
Louisiana	12, 185	12, 436	12, 291	13, 291	14, 639	15, 519	15, 071	14, 736	14, 114	13, 957	14, 156	14, 042	14, 692
Michigan	1, 094	1, 156	1, 161	1, 146	1, 136	1, 183	1, 261	1, 287	1, 097	1, 167	1, 115	1, 229	1, 163
Mississippi	1, 826	1, 434	1, 584	1, 195	1, 337	1, 532	1, 375	1, 111	1, 120	1, 102	1, 095	1, 025	995
Montana	658	636	680	794	918	890	850	852	860	770	850	897	940
New Mexico	5, 803	6, 016	6, 476	6, 956	7, 071	6, 908	6, 737	7, 061	7, 656	7, 498	7, 492	7, 379	7, 100
New York	281	262	296	316	304	303	295	343	375	313	243	212	202
Ohio	500	418	466	492	480	442	462	554	542	535	533	542	562
Oklahoma	39, 196	38, 488	38, 229	38, 208	37, 680	37, 151	37, 232	36, 660	35, 969	34, 849	33, 530	32, 901	31, 964
Pennsylvania	1, 655	1, 583	1, 548	1, 423	1, 410	1, 392	1, 491	1, 578	1, 489	1, 564	1, 314	1, 276	1, 364
Texas	104, 259	104, 737	105, 471	107, 019	106, 877	107, 371	104, 685	104, 910	103, 884	105, 811	109, 914	113, 379	115, 489
West Virginia	829	827	773	704	766	624	608	603	573	568	573	613	587
Wyoming	12, 941	12, 632	12, 670	12, 754	12, 628	12, 768	12, 337	12, 280	12, 191	11, 644	11, 216	10, 961	10, 504
Foreign	198	221	114	148	111	93	95	179	1, 177	520	1, 025	963	1, 329
Total United States	234, 889	234, 958	237, 610	242, 716	243, 469	244, 415	241, 136	239, 824	237, 620	236, 822	239, 986	243, 279	243, 506
Heavy crude in California	10, 865	10, 804	10, 394	10, 402	9, 674	9, 748	10, 064	10, 279	10, 009	8, 905	8, 716	8, 170	8, 289

[1] Final figures.

[2] Heavy crude stocks in California given below.

Stocks of crude petroleum [1] in the United States in 1943, by location and months

[Thousands of barrels]

Classification	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
At refineries:													
Arkansas	334	327	338	324	287	270	265	265	330	316	342	315	323
California and Washington	8, 342	8, 203	8, 505	8, 889	8, 870	8, 861	8, 380	8, 266	7, 604	8, 055	7, 252	7, 047	7, 113
Georgia, Maryland, Massachusetts, Rhode Island, and South Carolina	1, 267	1, 212	1, 211	1, 113	1, 284	1, 398	1, 609	1, 698	1, 771	1, 308	1, 844	2, 089	1, 851
Illinois, Minnesota, and Wisconsin	2, 144	2. 190	2, 210	2, 224	2, 168	1, 930	1, 788	1, 899	1, 960	2, 182	2, 071	2, 168	2, 108
Indiana	1, 148	1, 232	1, 331	1, 398	1, 520	1, 544	1, 511	1, 547	1, 448	1, 445	1, 597	1, 605	1, 523
Kansas and Nebraska	1, 219	1, 365	1, 324	1, 422	1. 500	1, 459	1, 424	1, 449	1, 370	1, 529	1, 597	1, 645	1, 604
Louisiana, Alabama, and Mississippi	2, 829	3, 004	3. 206	4, 247	5, 627	5. 764	5, 602	4, 973	4, 375	4, 522	4, 523	4, 874	4. 949
Michigan and Kentucky	1, 160	1. 084	1, 142	1, 177	1, 256	1. 273	1, 212	1, 312	1, 379	1, 268	1, 333	1, 412	1, 243
Missouri	251	252	245	249	248	216	248	245	250	232	251	258	258
Montana and Colorado	575	534	543	596	668	623	639	628	580	554	629	698	605
New Jersey	2, 300	2, 444	2, 366	2, 259	2, 201	2, 320	3, 142	2, 942	3, 208	2, 902	3, 270	2, 947	2, 935
New Mexico	46	45	35	19	35	46	26	41	40	29	24	23	38
New York	538	525	614	732	709	720	874	846	921	1, 003	607	529	589
Ohio	1, 213	1, 227	1, 300	1, 379	1, 088	993	1, 067	944	1, 080	958	1, 128	932	1, 097
Oklahoma	1, 801	1, 729	1, 897	1, 855	1, 672	1, 593	1, 475	1, 783	1, 762	1, 844	1. 755	1, 954	1, 732
Pennsylvania	2, 818	2, 878	2, 704	2, 887	2, 967	3, 261	3, 850	3, 563	3, 757	3, 412	3, 264	3, 692	3, 036
Texas	14, 439	14, 790	14, 660	14, 417	14, 274	13, 979	14, 236	14, 495	15, 058	15, 428	15, 288	15, 384	15, 539
West Virginia	37	33	34	49	58	64	74	90	69	75	85	53	52
Wyoming, Idaho, and Utah	1, 159	1, 139	1, 209	1, 190	1, 207	1, 248	1, 240	1, 237	1, 198	1, 146	1, 052	1, 079	1, 124
Total at refineries	43, 620	44, 213	44, 874	46, 426	47, 639	47, 562	48, 662	48, 223	48, 160	48, 208	47, 912	48. 704	47, 719
Pipe-line and tank-farm stocks:													
Arkansas	896	1, 554	1, 861	1, 832	1, 793	1, 863	1, 950	2, 029	2, 184	2, 148	2, 151	2, 268	2, 273
California	20, 058	20, 333	20, 625	20, 940	20, 915	20, 948	20, 737	20, 055	20, 061	20, 048	20, 591	20, 921	19, 486
Illinois and Indiana	8, 436	8, 609	9, 134	10, 070	10, 907	11, 253	12, 015	12, 868	13, 470	13, 901	14, 977	15, 613	14, 757
Kansas and Nebraska	6, 367	5, 773	5, 670	5, 606	5, 628	5, 525	5, 066	5, 099	5, 430	5, 270	4, 924	5, 042	4, 762
Louisiana and Mississippi	5, 556	5, 494	6, 408	7, 275	7, 272	8, 180	8, 314	8, 231	8, 631	8, 165	8, 697	8, 990	9, 480
Michigan, Kentucky, and Tennessee	1, 698	1, 648	1, 652	1, 580	1, 608	1, 679	1, 803	1, 899	1, 723	1, 724	1, 652	1, 726	1, 935
Missouri and Iowa	3, 858	3, 825	4, 154	4, 133	4, 204	4, 483	4, 540	4, 399	4, 392	4, 223	4, 334	4, 352	4, 553
Montana and Colorado	615	565	543	619	662	666	564	554	592	487	485	548	607
New Jersey	328	366	482	361	378	343	342	329	320	216	341	300	327
New Mexico	858	860	920	870	864	860	778	965	730	1, 056	838	757	947
Ohio	4, 843	5, 420	5, 806	6, 441	6, 736	5, 971	6, 127	6, 875	6, 124	5, 742	5, 418	5, 291	5, 692
Oklahoma	28, 987	28, 505	28, 583	28, 750	28, 413	28, 684	28, 769	28, 001	28, 037	26, 864	26, 303	25, 020	25, 076
Pennsylvania, New York, and West Virginia	3, 592	3, 495	3, 474	3, 409	3, 324	3, 227	3, 099	3, 982	3, 998	4. 088	4, 438	4, 573	4, 612
Texas	81, 597	80, 484	79, 705	80, 690	79, 641	79, 294	75, 135	73, 339	70, 895	72, 289	74, 409	76, 867	79, 246
Wyoming and Utah	10, 215	10, 025	10. 102	10, 133	9, 968	10, 098	9, 703	9, 565	9, 428	8, 865	8, 376	8, 150	7, 669
Total pipe line and tank farm	177, 904	176, 956	179, 119	182, 709	182, 313	183, 074	178, 942	178, 190	176, 015	175, 086	177, 934	180, 418	181, 422
Producers' stocks 1943 [2]	13, 365	13, 789	13, 617	13, 581	13, 517	13, 779	13, 532	13, 411	13, 445	13, 528	14, 140	14, 157	14, 365
1942 [2]	12, 188	12, 501	12, 910	13, 102	12, 859	13, 354	13, 082	12, 875	13, 478	13, 194	13, 146	13, 531	13, 365
Total United States:													
1943 [2]	234, 889	234, 958	237, 610	242, 716	243, 469	244, 415	241, 136	239, 824	237, 620	236, 822	239, 986	243, 279	243, 506
1942 [2]	247, 499	254, 146	261, 459	262, 392	258, 321	255, 142	251, 986	245, 591	244, 670	240, 588	237, 901	234, 635	234, 889

[1] Excludes stocks of California heavy crude.

[2] Final figures.

CONSUMPTION AND DISTRIBUTION

Runs to stills.—Total crude runs to stills amounted to 1,430 million barrels in 1943, a gain of 96 million barrels (7.2 percent) compared with 1942. Foreign crude runs declined to 12 million barrels, the lowest level in years, but runs of domestic crude rose to a record level of 1,418 million barrels.

The principal changes in refinery operations, by districts, in 1943 were gains of 34 million barrels in crude runs in California, 33 million in the East Coast, and 28 million in the Texas Gulf Coast. The amount of crude run in California has increased steadily to meet the large demand for oil to supply the requirements of the Navy, war industries, and the railroads. Crude runs were 24 percent higher in 1943 than in 1941. Runs in the East Coast and Texas Gulf Coast districts rose with the improvement in overland transportation facilities for both crude petroleum and refined products, although they were still below the peak levels of 1941.

Distribution.—The total demand for domestic crude petroleum rose from 1,396 million barrels in 1942 to a new record of 1,498 million barrels in 1943—a gain of 102 million barrels or over 7 percent. The increased demand for crude petroleum was due primarily to the gain of 117 million barrels in crude production in 1943. The effect of the increase in the imports of refined products—from 24 million barrels in 1942 to 50 million in 1943—was offset by a reduction of only 18 million barrels in stocks of refined oils compared with the decline of 47 million barrels in such stocks in 1942.

Receipts of domestic and foreign crude petroleum at United States refineries totaled 1,328 million barrels in 1942 and 1,436 million in 1943. In 1943 receipts of foreign crude petroleum were only about 14 million barrels or less than 1 percent of the total; interstate receipts of domestic crude were 563 million barrels or 39.2 percent of the total; and intrastate receipts were 859 million barrels or 59.8 percent of the total. These percentages were virtually the same as in 1942.

Refinery receipts of crude in 1943, by methods of transportation, indicated that 82.1 percent of the total was delivered by pipe lines compared with 80.0 percent in 1942; that 10.7 percent was delivered by tank car and truck compared with 10.1 percent in 1942; and that only 7.2 percent was delivered by boat compared with 9.9 percent in 1942. These figures indicate the continuation of the abrupt decline in boat movements since 1941 and the further relative gain in overland shipments.

The major changes in the market demand for crude petroleum by States of origin (computed from production and changes in crude stocks by origin) in 1943 compared with 1942 were increases of about 121 million barrels for Texas, 38 million for California, 7 million for Kansas, 5 million for Louisiana, and 4 million for New Mexico. The largest decreases in crude demand were 37 million barrels for Illinois, 23 million for Oklahoma, 10 million for Mississippi, and 2 million for Pennsylvania. These changes indicate shifts in production trends and in accessibility to market under disturbed transportation conditions, as well as the availability of accumulated stocks.

Twelve States had a market demand in excess of 10 million barrels a year in 1943.

Runs to stills of crude petroleum in the United States in 1943, by districts and months [1]

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
East Coast:													
Domestic	13,162	12,175	13,364	13,584	13,811	14,319	15,854	17,487	16,878	17,127	17,032	17,733	182,526
Foreign	84	18	37	119	50	380	36	1,032	2,192	2,195	2,607	2,943	11,693
Total East Coast	13,246	12,193	13,401	13,703	13,861	14,699	15,890	18,519	19,070	19,322	19,639	20,676	194,219
Appalachian	4,849	4,303	4,653	4,764	4,857	4,578	4,365	4,779	4,702	4,403	4,233	4,414	54,900
Indiana, Illinois, Kentucky, etc.	22,240	20,115	21,767	21,029	22,359	21,362	22,559	22,808	22,399	22,818	22,429	23,349	265,234
Oklahoma, Kansas, Missouri, etc.	10,202	9,707	10,526	10,449	10,444	10,475	10,397	10,228	10,300	10,689	10,180	10,570	124,167
Texas Inland	5,848	5,364	5,651	5,803	5,933	6,193	6,369	6,508	6,119	6,376	6,144	6,685	72,993
Texas Gulf Coast:													
Domestic	24,843	22,311	25,672	24,576	26,065	26,788	27,691	30,480	30,260	32,348	31,585	32,003	334,622
Foreign	147	83	67	70				2	8				377
Total Texas Gulf Coast	24,990	22,394	25,739	24,646	26,065	26,788	27,691	30,482	30,268	32,348	31,585	32,003	334,999
Louisiana Gulf Coast:													
Domestic	3,930	3,576	4,087	4,217	4,534	4,511	5,052	5,560	5,419	5,323	5,222	5,597	57,028
Foreign				17	48	5			16	22		1	109
Total Louisiana Gulf Coast	3,930	3,576	4,087	4,234	4,582	4,516	5,052	5,560	5,435	5,345	5,222	5,598	57,137
Arkansas-Louisiana Inland	2,120	2,120	2,231	2,169	2,347	2,185	2,336	2,247	2,491	2,229	2,309	2,332	27,116
Rocky Mountain	3,017	2,447	2,722	2,804	2,650	3,126	2,862	2,880	3,380	3,165	2,951	3,101	35,105
California	21,164	19,716	21,236	22,344	21,907	22,062	23,168	22,897	21,924	22,341	21,781	23,328	263,868
Total domestic	111,375	101,834	111,909	111,739	114,907	115,599	120,653	125,874	123,872	126,819	123,866	129,112	1,417,559
Total foreign	231	101	104	206	98	385	36	1,034	2,216	2,217	2,607	2,944	12,179
Total United States	111,606	101,935	112,013	111,945	115,005	115,984	120,689	126,908	126,088	129,036	126,473	132,056	1,429,738
Daily average	3,600	3,641	3,613	3,732	3,710	3,866	3,893	4,094	4,203	4,162	4,216	4,260	3,917

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[1] Subject to revision

Demand for crude petroleum in the United States, 1940–43, by States of origin

[Thousands of barrels]

State	1940		1941		1942		1943 [1]	
	Total	Daily ave.	Total	Daily ave.	Total	Daily ave.	Total	Daily ave.
Arkansas	24,992	68.3	27,206	74.5	26,902	73.7	27,143	74.4
California	224,931	614.6	232,246	636.3	250,479	686.2	288,410	790.2
Colorado	1,659	4.5	2,050	5.6	2,191	6.0	2,431	6.7
Illinois	144,658	395.2	134,327	368.0	115,417	316.2	78,396	214.8
Indiana	4,559	12.5	7,869	21.6	6,638	18.2	5,340	14.6
Kansas	64,322	175.7	84,209	230.7	98,281	269.3	105,715	289.7
Kentucky	5,075	13.9	4,677	12.8	4,687	12.8	7,775	21.3
Louisiana	101,185	276.5	116,420	319.0	116,394	318.9	121,085	331.7
Michigan	20,252	55.3	15,616	42.8	22,318	61.2	20,699	56.7
Mississippi	3,490	9.5	13,632	37.3	29,646	81.2	19,638	53.8
Montana	6,964	19.0	7,146	19.6	8,824	24.2	7,634	20.9
Nebraska	270	.7	1,881	5.2	1,234	3.4	613	1.7
New Mexico	37,600	102.7	40,061	109.8	32,819	89.9	37,114	101.7
New York	4,908	13.4	5,294	14.5	5,364	14.7	5,138	14.1
Ohio	3,164	8.7	3,666	10.0	3,552	9.7	3,260	8.9
Oklahoma	153,083	418.3	166,357	455.8	153,413	420.3	130,384	357.2
Pennsylvania	17,481	47.8	16,771	45.9	18,311	50.2	16,048	44.0
Texas	480,454	1,312.7	507,283	1,389.8	461,425	1,264.2	582,290	1,595.3
West Virginia	3,680	10.1	4,006	11.0	3,843	10.5	3,591	9.8
Wyoming	27,525	75.2	29,737	81.5	34,401	94.3	35,514	97.3
Other States	71	.2	63	.1	45	.1	48	.1
Total United States	1,330,323	3,634.8	1,420,517	3,891.8	1,396,184	3,825.2	1,498,266	4,104.9

[1] Subject to revision.

The total demand for Texas crude rose from 461 million barrels in 1942 to 582 million in 1943—a gain of over 26 percent. In 1943 about 344 million barrels of Texas crude were delivered to refineries within the State—an increase of 35 million compared with 1942. Shipments to refineries in other States amounted to 226 million barrels or 88 million more than in 1942. Deliveries to East Coast refineries rose from 76 million barrels to 138 million, and deliveries to the Illinois, Indiana, Kentucky, etc., district increased from 42 million to 63 in 1943. A new production record was established for Texas, and 11 million barrels were added to crude stocks of origin during the year.

The demand for California crude increased from 250 million barrels in 1942 to over 288 million in 1943—a gain of 15 percent. A gain of 36 million barrels in production was supplemented by a withdrawal of 4 million barrels from crude stocks. Even with this large increment in crude supply, war demands for oil products were so high as to require a reduction of 23 million barrels in the stocks of refined oils.

The demand for Oklahoma crude was reduced from 153 million barrels in 1942 to 130 million in 1943. This decrease was due primarily to a further decline in production as the liquidation of crude stocks of origin amounted to only 7 million barrels compared with almost 13 million in 1942. Deliveries to refineries within the State were reduced by about 4 million barrels to 48 million, and deliveries to refineries in other States declined 20 million barrels. Shipments to Indiana and Illinois dropped from 48 million barrels in 1942 to 35 million in 1943.

Daily average demand for domestic crude petroleum in the United States in 1943, by States of origin and by months [1]

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Arkansas	83.3	70.4	68.7	75.0	70.8	69.1	62.8	82.1	85.9	69.2	79.2	75.9	74.4
California	754.8	768.4	750.3	806.2	769.2	792.3	797.4	807.7	803.7	797.2	808.1	826.2	790.2
Colorado	7.7	5.6	5.8	6.4	6.1	7.5	8.2	6.0	7.7	7.2	4.0	7.9	6.7
Illinois	235.0	215.9	200.6	237.8	214.3	181.1	228.8	219.7	217.8	202.1	202.7	221.1	214.8
Indiana	15.0	16.6	15.5	14.9	13.3	14.4	15.9	14.5	15.8	14.5	13.6	11.7	14.6
Kansas	277.9	290.7	306.9	296.2	299.7	297.3	291.5	296.4	285.8	281.9	278.5	272.8	289.7
Kentucky	17.7	24.3	14.5	17.0	21.4	21.1	25.8	19.4	26.9	26.6	21.2	20.1	21.3
Louisiana	309.6	332.0	300.4	300.7	311.1	337.9	348.2	363.3	354.2	346.6	350.5	326.8	331.7
Michigan	55.6	57.9	58.4	59.8	58.5	54.6	55.8	62.5	55.3	56.4	50.4	55.3	56.7
Mississippi	69.6	51.4	65.4	51.2	47.1	59.0	59.7	50.5	49.6	46.6	49.3	45.9	53.8
Montana	19.2	18.9	16.9	17.0	22.2	23.2	21.9	21.6	25.9	19.9	21.9	22.2	20.9
Nebraska	2.1	2.1	2.2	2.2	2.0	1.9	1.7	1.7	1.5	1.3	1.1	.4	1.7
New Mexico	89.9	83.0	79.0	96.7	107.2	110.7	98.6	90.5	116.6	111.5	115.3	120.4	101.7
New York	14.1	12.7	14.0	14.6	14.0	14.8	12.6	12.8	16.2	15.2	14.4	13.5	14.1
Ohio	10.8	7.0	8.6	9.5	10.2	8.8	6.3	10.2	9.5	8.9	8.9	8.4	8.9
Oklahoma	363.4	359.7	350.6	357.8	346.8	336.3	352.0	354.4	371.4	376.1	357.7	360.5	357.2
Pennsylvania	46.1	45.1	49.8	45.4	44.7	42.3	41.0	45.8	40.5	48.3	42.2	36.4	44.0
Texas	1,305.3	1,331.6	1,353.4	1,451.4	1,505.3	1,588.0	1,618.2	1,760.2	1,779.6	1,777.9	1,831.1	1,825.0	1,595.3
West Virginia	9.6	11.3	9.8	9.4	13.3	10.5	9.2	9.9	9.3	8.8	7.5	9.4	9.8
Wyoming	95.2	82.8	86.5	95.3	84.5	104.7	95.0	96.7	115.1	107.3	103.6	100.5	97.3
Other States [2]	.1	1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
Total United States	3,782.0	3,787.5	3,757.4	3,964.6	3,961.8	4,075.6	4,150.7	4,326.0	4,388.4	4,323.6	4,361.3	4,360.5	4,104.9

[1] Subject to revision.

[2] Missouri, Tennessee, and Virginia.

The demand for Louisiana crude rose from 116 million barrels in 1942 to 121 million in 1943. Deliveries to refineries within the State increased substantially as markets outside the State were curtailed by transportation difficulties. Crude production exceeded demand, and several million barrels were added to stocks of origin.

The demand for Kansas crude continued to rise and amounted to about 106 million barrels in 1943—a gain of almost 8 percent. Demand closely approximated production as the increase in crude stocks of origin was small. Deliveries to refineries within the State totaled 44 million barrels and were virtually the same as in 1942. Shipments to Indiana and Illinois rose from 34 million barrels in 1942 to about 44 million in 1943.

The market demand for Illinois crude has declined each year from the peak of 1940. Demand amounted to about 78 million barrels in 1943—a loss of 37 million barrels or 32 percent compared with 1942. Production was about 24 million barrels less in 1943; but crude stocks of origin increased by about 4 million barrels during the year, whereas such stocks were reduced by 9 million barrels in 1942. Deliveries to refineries within the State fell from 34 million barrels in 1942 to 26 million in 1943.

The demand for New Mexico crude rose from 33 million barrels in 1942 to 37 million in 1943. Deliveries to refineries within the State amounted to 3 million barrels. About 25 million barrels were shipped to Texas refineries and over 7 million barrels to refineries in Illinois.

The demand for Wyoming crude increased about 1 million barrels to total less than 36 million in 1943. As there was only a minor gain in production, the increase was due primarily to a greater liquidation of stocks of origin. Deliveries of about 14 million barrels to refineries in the State were slightly less than in 1942. Shipments to adjacent States showed a small gain, and there was an increase of about 1 million barrels in deliveries to Indiana and Illinois.

The demand for Arkansas crude remained virtually stationary at about 27 million barrels in 1943. Deliveries to refineries within the State amounted to about 13 million barrels. A decline of about 1 million barrels in shipments to the Louisiana Gulf district was offset by a gain in deliveries to Ohio refineries.

The demand for Michigan crude declined to less than 21 million barrels in 1943—a loss of over 1 million. This decrease was due primarily to reduced production and resulted in smaller deliveries to refineries within the State.

The demand for Mississippi crude amounted to less than 20 million barrels in 1943—a decline of 10 million barrels compared with 1942. Shipments to the East Coast district were reduced by 8 million barrels, and deliveries to Louisiana refineries declined about 3 million barrels. A substantial gain in movements to Kentucky and Ohio was almost offset by reduced deliveries to Illinois.

The demand for Pennsylvania crude was reduced by over 2 million barrels in 1943. The total demand of 16 million barrels closely approximated production for the year.

Distribution of crude petroleum in the United States in 1943, by States[1]

[Thousands of barrels]

State	Production	Refinery receipts of domestic crude, by origin							Runs to stills	Transfers to fuel
		Illinois	Kansas	Louisiana	New Mexico	Oklahoma	Texas	Other		
Arkansas	27,600							13,091	13,091	269
California	284,235							263,126	[2] 263,868	18,864
Colorado	2,320							3,527	3,627	34
Georgia[3]							503		505	
Illinois	82,260	26,435	18,220	378	7,404	16,611	15,337	3,784	[4] 88,154	692
Indiana	5,283	1,920	25,773	275	218	18,539	31,801	4,866	83,017	39
Kansas[5]	106,813		43,621			8,645	2,588	3,569	57,924	362
Kentucky[6]	7,895	2,293		466				14,152	16,862	36
Louisiana:										
Gulf	96,194			51,484			7,861	934	[7] 57,137	1,285
Inland	27,398			3,390			4,182	6,550	13,031	389
Maryland				4,667			5,247	101	11,048	
Massachusetts[8]		2,439	2,163	4,735		66	8,088	898	18,301	
Michigan	20,768	1,980				3,560	5,822	16,772	28,049	383
Mississippi	18,807								994	46
Missouri	36		3,087			3,139	2,829	304	9,350	36
Montana	7,916							10,160	10,014	30
New Jersey		2,249	947	6,563	120	3,541	44,078	5,662	67,762	
New Mexico	38,411				2,860		624		3,489	128
New York:										
East		1,026				500	5,251		7,095	
West	5,059	4,756	61			4,369		4,427	13,520	
Ohio:										
East	3,322	10,075				502	252	7,361	18,208	
West		19,353	784	2,104		8,959	10,424	7,445	49,152	137
Oklahoma	123,152		3,863			48,034	4,962		56,893	804
Pennsylvania:										
East		207	928	1,858	84	5,651	75,011	173	89,508	
West	15,757	394		403		1,226	819	15,469	18,325	12
Texas:										
Gulf	200,128			30,693	20,527	7,796	276,672	75	334,999	1,381
Inland	393,392			25	4,785	770	67,561		72,993	1,529
Utah								4,216	4,167	
West Virginia	3,349	214		134		1,099		3,412	4,847	
Wyoming[9]	33,077							13,749	13,808	685
Other	4									
Total United States	1,503,176	73,341	99,447	107,175	35,998	133,007	569,912	403,823	1,429,738	27,141

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[1] Subject to revision.
[2] Includes Washington.
[3] Includes Delaware, South Carolina, and Virginia.
[4] Includes Minnesota and Wisconsin.
[5] Includes Nebraska and South Dakota.
[6] Includes Tennessee.
[7] Includes Alabama.
[8] Includes Rhode Island.
[9] Includes Idaho.

Receipts of crude petroleum at refineries in the United States, 1939–43, by methods of transportation

[Millions of barrels]

Method of transportation	1939	1940	1941	1942	1943 [1]
By boat:					
Intrastate	72.7	72.1	69.1	45.2	54.4
Interstate	188.6	205.6	199.9	74.3	35.2
Foreign	33.1	42.6	50.6	12.2	13.8
Total by boat	294.4	320.3	319.6	131.7	103.4
By pipe lines:					
Intrastate	651.3	671.0	728.9	731.2	788.8
Interstate	250.5	268.9	313.1	330.5	390.1
Total by pipe lines	901.8	939.9	1,042.0	1,061.7	1,178.9
By tank car and truck:					
Intrastate	29.5	26.1	17.2	18.0	15.7
Interstate	10.9	12.7	31.3	116.3	138.2
Total by tank car and truck	40.4	38.8	48.5	134.3	153.9
Grand total	1,236.6	1,299.0	1,410.1	1,327.7	1,436.2

[1] Subject to revision.

PRICES AND VALUE

Efforts were made by the petroleum industry and the Petroleum Administration for War to promote a general increase in crude-oil prices. The Office of Price Administration, however, denied the requests and recommended subsidies to maintain production from stripper wells, a program for stimulating exploration by premium prices for oil from new discoveries, Government loans for drilling, and higher prices in extreme shortage areas only. An appeal was taken to the Economic Stabilizer, but he disapproved a general increase and suggested that the industry seek other means of adjusting payments so that oil from marginal wells would not be lost and that exploratory drilling should be continued. The question of price increase was carried to Congress, where a bill was passed in the House December 13 providing for a price of not less than 80 percent of parity and not more than parity. This bill would have allowed price increases of from 35 cents to 74 cents a barrel.

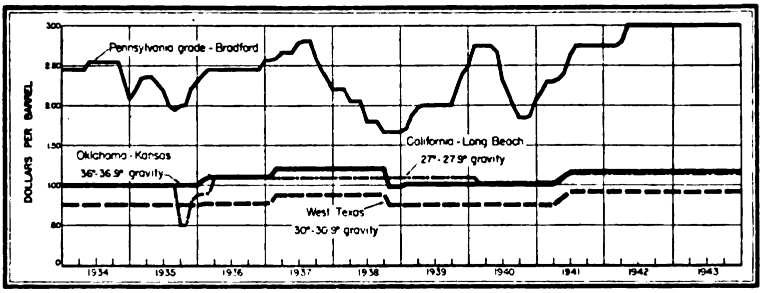

FIGURE 5.—Posted prices of selected grades of crude petroleum in the United States, 1934–43, by months.

The Office of Price Administration permitted but few increases in ceiling prices of crude oil during 1943. The principal exception was in California, where prices were increased April 1 on a graduated scale according to gravities, the maximum being an increase of 25 cents for crudes of 15° gravity and heavier. Increases under this schedule decline sharply as the gravity rises, with the effect that light oils received no increase. Prices for heavy crude oils in Wyoming likewise were increased 15 cents per barrel early in the year, and Panhandle Texas crude-oil prices advanced 7 cents. An action having the effect of a price increase in the Bradford field in Pennsylvania and New York was the reduction in the allowance for basic sediment and water from 2 percent to 1 percent.

The national average value of crude petroleum at the well will show little change in 1943 compared with the average of $1.19 per barrel in 1942. The principal gains in production were in Texas, California, Kansas, Louisiana, and New Mexico, where the value of crude is close to or below the national average. The principal decreases in production were in Illinois, with an average value of $1.36 per barrel in 1942; in Oklahoma, with an average value of $1.19 in 1942; and in Mississippi, with an average value of $0.92 in 1942.

Value of crude petroleum at wells in the United States, 1941–42, by States [1]

State	1941		1942	
	Total (thousands of dollars)	Average per barrel	Total (thousands of dollars)	Average per barrel
Arkansas	24, 500	$0. 93	26, 300	$0. 99
California	239, 500	1. 04	255, 800	1. 03
Colorado	2, 300	1. 07	2, 440	1. 11
Illinois	172, 100	1. 30	144, 800	1. 36
Indiana	9, 400	1. 27	9, 100	1. 35
Kansas	95, 700	1. 15	117, 100	1. 20
Kentucky	6, 200	1. 30	6, 150	1. 36
Louisiana:				
Gulf Coast	102, 600	1. 13	102, 500	1. 19
Northern	29, 500	1. 18	35, 300	1. 20
Total, Louisiana	132, 100	1. 14	137, 800	1. 19
Michigan	21, 900	1. 34	30, 300	1. 39
Mississippi	14, 000	. 91	26, 600	. 92
Montana	8, 000	1. 06	8, 950	1. 11
Nebraska	1, 600	. 84	1, 110	. 90
New Mexico	37, 200	. 94	31, 550	1. 00
New York	13, 300	2. 57	16, 000	2. 95
Ohio	5, 750	1. 64	6, 730	1. 90
Oklahoma	174, 800	1. 13	168, 000	1. 19
Pennsylvania	42, 500	2. 54	52, 250	2. 94
Texas:				
Gulf Coast	167, 000	1. 24	175, 700	1. 30
East Texas proper	151, 000	1. 14	144, 700	1. 18
West Texas	90, 000	. 97	81, 000	. 99
Rest of State	160, 000	1. 10	163, 000	1. 14
Total, Texas	568, 000	1. 12	564, 400	1. 17
West Virginia	7, 390	2. 15	9, 040	2. 53
Wyoming	25, 700	. 86	29, 000	. 88
Other States [2]	60	. 95	50	1. 11
Total, United States	1, 602, 000	1. 14	1, 643, 470	1. 19

[1] Figures for 1943 not yet available.

[2] Missouri, Tennessee, and Utah for 1941; Missouri and Tennessee for 1942.

Average monthly price per barrel for selected grades of crude petroleum at wells in the United States in 1943

Month	Pennsylvania Grade		Illinois Basin	Okla-homa-Kansas, 36°-36.9°	Panhandle, Tex. (Carson and Hutchinson Counties), 35°-35.9°	West Texas, 30°-30.9°	East Texas	Gulf-Coast Grade, 30°-30.9°	California (Long Beach), 27°-27.9°
	Bradford	Southwest Pennsylvania							
January	3.00	2.65	$1.37	$1.17	$1.05	$0.92	$1.25	$1.28	$1.15
February	3.00	2.65	1.37	1.17	1.05	.92	1.25	1.28	1.15
March	3.00	2.65	1.37	1.17	1.05	.92	1.25	1.28	1.15
April	3.00	2.65	1.37	1.17	1.05	.92	1.25	1.28	1.15
May	3.00	2.65	1.37	1.17	1.05	.92	1.25	1.28	1.15
June	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
July	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
August	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
September	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
October	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
November	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
December	3.00	2.65	1.37	1.17	1.12	.92	1.25	1.28	1.15
Average for year	3.00	2.65	1.37	1.17	1.09	.92	1.25	1.28	1.15

Posted price per barrel of petroleum at wells in the United States in 1943, by grades, with dates of change

Date	Pennsylvania Grade		Corning Grade in Buckeye Pipe Line Co.[3]	Western Kentucky[3]	Illinois Basin[4]	Midland, Mich.[5]	Oklahoma-Kansas[6]	
	Bradford and Allegany districts[1]	In Southwest Pennsylvania pipe lines[2]					34°-34.9°	36°-36.9°
Jan. 1	$3.00	$2.65	$1.31	$1.32	$1.37	$1.44	$1.13	$1.17
July 1				1.37				
	3.00	2.65	1.31	1.35	1.37	1.44	1.13	1.17

Date	Panhandle, Texas (Carson and Hutchinson Counties), 35°-35.9°[7]	West Texas, 30°-30.9°[7]	Lea County, N. Mex., 30°-30.9°[7]	Southwest Texas, Duval-Mirando, 22°-22.9°[7]	East Texas[7]	Gulf Coast			
						Conroe, Tex.[8]	30°-30.9°[8]	20°-20.9°[8]	Tepetate, La.[9]
Jan. 1	$1.05	$0.92	$0.92	$1.09	$1.25	$1.43	$1.28	$1.08	$1.18
June 16	1.12								
	1.09	.92	.92	1.09	1.25	1.43	1.28	1.08	1.18

Date	Rodessa, La., 36°-36.9°[10]	Smackover, Ark.[10]	Salt Creek, Wyo., 36°-36.9°[11]	Lance Creek, Wyo.[4]	California[12]			
					Kettleman, 37°-37.9°	Long Beach, 27°-27.9°	Midway-Sunset, 19°-19.9°	Santa Fe Springs, 33°-33.9°
Jan. 1	$1.12	$0.83	$1.12	$1.12	$1.29	$1.15	$0.81	$1.26
April 1							.98	
	1.12	.83	1.12	1.12	1.29	1.15	.94	1.26

[1] The Tide Water Associated Oil Co.
[2] The South Penn Oil Co.
[3] Sohio Corporation.
[4] The Ohio Oil Co.
[5] The Pure Oil Co.
[6] Standard Oil Co. (Indiana).
[7] Humble Oil & Refining Co.
[8] The Texas Co.
[9] Continental Oil Co.
[10] Standard Oil Co. of Louisiana.
[11] Stanolind Oil & Gas Co.
[12] Standard Oil Co. of California.

REFINED PRODUCTS

GENERAL REVIEW

Whereas the petroleum industry in 1942 was characterized by great changes involving initiation of projects to meet the demands of war, the features of 1943 were the fruition of those projects and the emergence of an orderly program of production.

The completion of new pipe lines, the clearing of the waters near United States shores of enemy submarines, and the expansion in the tanker fleet resulted in a major improvement in the transportation of crude petroleum and products in 1943. The critical shortage in the Eastern States was relieved at the end of the first quarter, and large supplies of crude oil and products became available, in the latter half of the year, from Venezuela and other Caribbean sources. Improved distribution made possible the expansion of crude production and runs to stills to record levels in 1943.

Comparative analyses of statistics for the major refined products in the United States, 1939–43

[Thousands of barrels, except as otherwise indicated]

	1939	1940	1941	1942	1943[1]
Motor fuel:					
Production	611,043	616,695	701,294	608,900	610,533
Imports	47	97	335	115	5,736
Exports	44,638	25,377	27,083	35,097	51,381
Stocks, end of period	81,722	83,647	90,688 [2] 90,596	75,404	69,505
Domestic demand	555,509	589,490	667,505	589,110	570,787
Kerosine:					
Production	68,521	73,882	72,586	67,474	72,270
Imports		204	191	418	375
Exports	8,241	3,374	3,221	2,576	4,619
Stocks, end of period	7,576	9,512	9,599 [2] 14,515	10,064	9,359
Domestic demand	60,503	68,776	69,469	69,767	68,731
Distillate fuel oil:					
Production	161,746	183,304	189,177	196,714	211,516
Transfers	2,741	2,576	2,513	2,496	3,070
Imports		3,333	5,074	3,636	15,992
Exports	32,020	19,140	16,925	21,575	24,862
Stocks, end of period	33,718	42,940 [2] 42,911	49,926 [2] 49,330	44,940	41,728
Domestic demand	134,973	160,851	172,824	185,661	208,935
Residual fuel oil:					
Production	305,944	316,221	342,367	358,901	417,306
Transfers	9,668	7,699	12,969	19,283	24,087
Imports	15,680	29,366	37,369	18,432	26,567
Exports	17,485	16,109	14,114	12,095	16,766
Stocks, end of period	92,290	89,304 [2] 88,026	83,195 [2] 82,959	61,783	48,484
Domestic demand	323,488	340,163	383,422	405,697	464,493
Lubricating oil:					
Production	35,036	36,765	39,539	38,626	38,679
Imports	5	11			
Exports	11,881	10,461	9,924	8,272	8,756
Stocks, end of period	7,142	8,767	8,127	9,424	7,781
Domestic demand	23,713	24,690	30,255	29,057	31,566
Wax (thousands of pounds):					
Production	464,520	513,240	670,040	700,560	755,160
Imports	39,913	83,102	16,542	9,749	109
Exports	232,664	189,794	213,075	153,519	172,799
Stocks, end of period	75,648	125,272	74,814	85,400	82,040
Domestic demand	325,461	356,924	523,965	546,204	585,830
Coke (thousands of short tons):					
Production	1,666.4	1,526.6	1,648.8	1,338.4	1,388.4
Exports	286.2	298.7	279.1	325.3	317.6
Stocks, end of period	666.0	487.0	228.0	233.8	258.2
Domestic demand	1,421.7	1,406.9	1,628.7	1,007.3	1,046.4

See footnotes at end of table.

Comparative analyses of statistics for the major refined products in the United States, 1939–43—Continued

[Thousands of barrels, except as otherwise indicated]

	1939	1940	1941	1942	1943 [1]
Asphalt (thousands of short tons):					
Production	4,954.2	5,346.7	6,557.6	6,296.5	6,756.7
Imports	73.9	137.7	158.3	121.2	113.0
Exports	42.4	296.4	274.1	113.8	159.2
Stocks, end of period	550.0	614.0	604.0	411.0	563.3
Domestic demand	4,926.1	5,124.0	6,451.8	6,496.9	6,558.2
Road oil:					
Production	7,868	7,771	9,149	8,039	2,295
Stocks, end of period	702	624	793	348	193
Domestic demand	7,846	7,849	8,980	8,484	2,450
Other finished products:					
Production	2,359	3,202	6,266	8,117	9,660
Exports	123	708	660	657	827
Stocks, end of period	276	359	384 [2] 489	597	734
Domestic demand	2,223	2,411	[3] 11,862	[3] 14,547	[3] 18,395

[1] Subject to revision.

[2] New basis—to compare with following year.

[3] Includes transfers of liquefied petroleum gases from natural gasoline.

Runs to stills and production at refineries in the United States of the various refined products, 1939–43

[Thousands of barrels, except as otherwise indicated]

Product	1939	1940	1941	1942	1943 [1]
Input:					
Crude petroleum:					
Domestic	1,204,350	1,252,364	1,358,246	1,319,507	1,417,559
Foreign	33,490	41,798	50,946	14,596	12,179
Total crude petroleum	1,237,840	1,294,162	1,409,192	1,334,103	1,429,738
Natural gasoline	39,606	39,547	47,825	56,595	61,198
Total input	1,277,446	1,333,709	1,457,017	1,390,698	1,490,936
Output:					
Gasoline	596,501	597,375	671,110	586,971	592,425
Kerosine	68,521	73,882	72,586	67,474	72,270
Distillate fuel oil	161,746	183,304	189,177	196,714	211,516
Residual fuel oil	305,944	316,221	342,367	358,901	417,306
Lubricating oil	35,036	36,765	39,539	38,626	38,679
Wax	1,659	1,833	2,393	2.502	2,697
Coke	8,332	7,633	8,244	6,692	6,942
Asphalt	27,248	29,406	36,067	34,631	37,162
Still gas	68,779	75,950	83,354	78,924	86,755
Wax ... thousands of pounds	464,520	513,240	670,040	700,560	755,160
Coke ... thousands of short tons	1,666.4	1,526.6	1,648.8	1,338.4	1,388.4
Asphalt ... do	4,954.2	5,346.7	6,557.6	6.296.5	6.756.7
Still gas ... millions of cubic feet	261,360	273,420	300,074	284,126	312,318
Road oil	7,868	7,771	9,149	8,039	2,295
Other finished products	2,359	3,202	6,266	8,117	9,660
Crude gasoline (net)	[2] 439	902	1,219	1,669	1,009
Other unfinished oils (net)	[2] 11,731	[2] 3,848	[2] 3,204	[2] 3,353	2,597
Shortage	5,623	3,313	[3] 1,250	4,791	9,623
Total output	1,277,446	1,333,709	1,457,017	1,390,698	1,490,936

[1] Subject to revision.

[2] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.

[3] Negative quantity (overage).

It was necessary to continue and extend the measures to reduce the civilian consumption of gasoline and fuel oils in 1943. The rationing of gasoline was instituted in the Eastern States on May 15, 1942, and put on a Nation-wide basis on December 1, 1942. Pleasure driving was prohibited in the East Coast area early in 1943, and when the ban was lifted in March the basic ration was cut from 3 gallons a week to 1½ gallons but was subsequently increased to 2 gallons. The rationing of heating oils for the winter of 1942–43 was initiated on October 1, 1942, and applied to the 30 Eastern and Midwestern States. In the first quarter of 1943, when oil transportation was at the most critical stage, it became necessary to cut the coupon value for heating oils. The shortage was most acute in the New England States. The situation was improved materially in the heating season of 1943–44. Although temporary shortages occurred in some areas, the unit coupon value was maintained. Extensive conversions from fuel oil to coal had helped materially to relieve the situation in the Eastern States. However, the program to secure further conversions was discontinued when oil-transportation conditions improved and when an impending shortage of coal made it necessary to ration that fuel. Owing to the continued expansion in war demands for oil and the growing labor shortage there seems to be little prospect of more liberal allowances of either gasoline or fuel oil for civilian use in 1944.

Research has advanced technology so rapidly since the war began that new equipment and new methods have made possible the production of vital materials that heretofore had been beyond the realm of practicability. These new developments have been particularly effective in meeting the major refinery problem of supplying the enormous war demand for aviation gasoline.

The total demand for the major refined products in 1943, as compared with 1942, shows a decline of 2.0 million barrels in motor-fuel demand, a gain of 63.5 million barrels (15 percent) in residual fuel-oil demand, an increase of 26.6 million barrels (13 percent) in distillate fuel-oil demand, a gain of 1.0 million barrels (1 percent) in kerosine demand, an increase of 3.0 million barrels (8 percent) in the demand for lubricating oils, and a decline of 5.5 million barrels (12 percent) in the combined demand for asphalt and road oil. These changes in demand reflect larger imports of fuel oils and gasoline, a gain of 27 million barrels in the exports of refined products, and a decline of only 18 million barrels in the stocks of refined oils in 1943 compared with a reduction of 47 million barrels in 1942.

The relative changes in the demand for the various products resulted in a substantial shift in refinery yields. The yield of gasoline from crude oil continued to decline from 44.2 percent in 1941 to 39.8 percent in 1942 and 37.1 percent in 1943. The yield of residual fuel oil rose from 24.3 percent in 1941 to 26.9 percent in 1942 and 29.2 percent in 1943. The yield of distillate fuel oil increased from 13.4 percent in 1941 to 14.7 percent in 1942 and 14.8 percent in 1943. With the rapid rise in crude runs to stills in the latter half of 1943 and early in 1944 and the sharp upward trend in the war demands for motor fuel, the yield of gasoline began to rise and the yield of residual fuel oil to decline.

Summary of percentage yields of refined products in the United States, 1935–43

[Computed on total crude runs to stills]

Product	1935	1936	1937	1938	1939	1940	1941	1942	1943[1]
Finished products:									
Gasoline:									
Cracked	21.5	22.4	22.6	23.2	23.9	22.7	24.4	22.3	22.0
Straight run	22.7	21.7	21.3	21.1	21.1	20.4	19.8	17.5	15.1
Total gasoline	44.2	44.1	43.9	44.3	45.0	43.1	44.2	39.8	37.1
Kerosine	5.8	5.2	5.5	5.5	5.5	5.7	5.2	5.1	5.0
Distillate fuel oil	10.4	11.8	12.4	13.0	13.1	14.2	13.4	14.7	14.8
Residual fuel oil	26.9	27.0	26.4	25.3	24.7	24.4	24.3	26.9	29.2
Lubricating oil	2.9	2.9	3.0	2.6	2.8	2.8	2.8	2.9	2.7
Wax	.2	.2	.2	.1	.1	.1	.2	.2	.2
Coke	.7	.6	.6	.7	.7	.6	.6	.5	.5
Asphalt	1.8	2.0	1.9	2.1	2.2	2.3	2.6	2.6	2.6
Road oil	.6	.7	.7	.6	.6	.6	.6	.6	.2
Still gas	5.3	5.3	5.4	5.7	5.5	5.5	5.9	5.9	6.1
Other	.2	.2	.2	.2	.2	.3	.4	.6	.7
Unfinished products:									
Gasoline	.1	(3)	(2 3)	[2].1	(2 3)	.1	.1	.1	(3)
Other	[2].3	[2].8	[2].7	[2].4	[2].9	[2].3	[2].2	[2].3	.2
Shortage	1.2	.8	.5	.4	.5	.6	[2].1	.4	.7
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Subject to revision.
[2] Negative percentage: represents excess percentage rerun over percentage produced.
[3] Less than 0.1 percent.

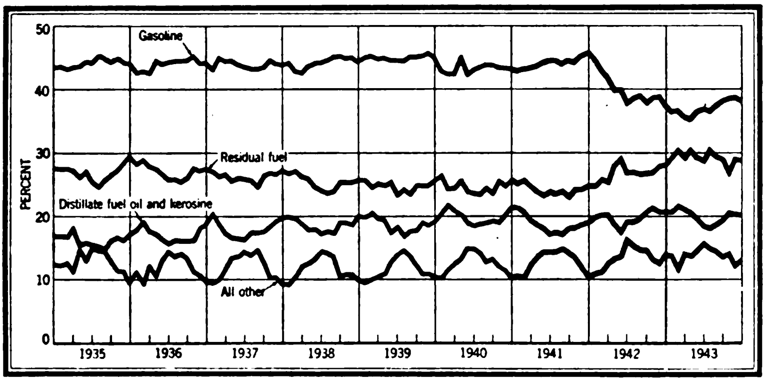

FIGURE 6.—Yields of principal products from crude oil run to stills in the United States, 1935–43, by months.

Total stocks of refined oils were reduced 47 million barrels in 1942 and were further reduced 18 million barrels in 1943. In 1942 refined stocks east of California declined 38 million barrels compared with a decrease of 9 million in the California area. In 1943 these stocks gained 5 million barrels east of California and declined 23 million barrels in California. The large reduction of stocks in 1942 reflected liquidations to meet demand during the major changes in transportation resulting from the development of overland movements to replace the Gulf-East Coast tanker shipments. The decrease in stocks in 1942 was caused primarily by the heavy demands, particularly for fuel oils, in the Pacific Coast area.

Stocks of refined products in the United States, 1942–43, by months

[Thousands of barrels, except as otherwise indicated]

Product	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
1942												
Gasoline	93,632	100,341	99,295	94,214	87,461	80,080	71,657	71,403	69,293	67,669	64,224	70,772
Kerosine	11,007	9,324	7,900	7,806	8,433	9,497	10,933	12,176	12,363	12,645	12,630	10,064
Distillate fuel oil	40,801	33,711	30,205	28,792	30,281	32,501	37,729	42,918	45,817	49,701	50,709	44,940
Residual fuel oil	78,386	75,386	70,098	67,658	68,388	66,341	66,935	67,613	69,264	68,873	66,664	61,783
Lubricating oil	8,266	8,429	8,470	8,470	8,768	8,756	8,945	9,301	9,278	9,421	9,336	9,424
Wax	260	270	268	249	247	249	243	275	278	308	309	305
Coke	1,229	1,294	1,262	1,005	956	909	875	895	864	918	988	1,169
Asphalt	3,823	4,210	4,074	3,957	3,395	2,826	2,398	2,181	2,018	1,887	1,871	2,261
Wax thousands of pounds	72,800	75,600	75,040	69,720	69,160	69,720	68,040	77,000	77,840	86,240	86,520	85,400
Coke thousands of short tons	245.8	258.8	252.4	201.0	191.2	181.8	175.0	179.0	172.8	183.6	197.6	233.8
Asphalt do	695.0	765.4	740.7	719.4	617.3	513.8	436.0	396.5	366.9	343.1	340.2	411.0
Road oil	863	909	965	1,006	980	900	833	565	475	394	356	348
Other finished products	453	503	526	556	595	552	517	502	534	537	553	597
Unfinished gasoline	7,724	8,111	7,549	7,695	7,220	7,437	7,789	8,123	8,853	8,953	8,992	9,354
Other unfinished oils	38,114	36,367	36,418	35,997	35,319	36,254	36,361	36,453	36,747	36,621	36,081	36,537
Total	284,558	278,855	267,030	257,405	252,043	246,302	245,215	252,405	255,784	257,927	252,713	247,554
1943 [1]												
Gasoline	78,475	82,867	84,077	78,653	73,137	67,345	62,791	60,664	59,186	59,100	59,854	64,964
Kerosine	7,222	5,942	4,868	5,326	6,486	8,237	9,195	10,286	10,910	11,299	10,487	9,359
Distillate fuel oil	39,014	35,298	31,135	30,674	30,665	32,467	34,324	36,931	39,681	44,857	44,806	41,728
Residual fuel oil	60,808	59,657	57,280	57,381	57,757	55,879	57,107	56,857	57,977	54,952	53,046	48,484
Lubricating oil	9,725	9,771	9,689	9,474	9,155	8,695	8,412	8,170	7,831	7,712	,770	7,781
Wax	300	291	298	301	306	291	274	263	277	291	290	293
Coke	1,366	1,382	1,471	1,550	1,574	1,623	1,698	1,775	1,785	1,774	1,625	1,291
Asphalt	2,749	3,040	3,694	3,872	4,101	3,934	3,530	3,091	2,581	2,450	2,555	3,098
Wax thousands of pounds	84,000	81,480	83,440	84,280	85,680	81,480	76,720	73,640	77,560	81,480	81,200	82,040
Coke thousands of short tons	273.2	276.4	294.2	310.0	314.8	324.6	339.6	355.0	357.0	354.8	325.0	258.2
Asphalt do	499.8	552.7	671.7	704.0	745.6	715.3	641.8	562.0	469.3	445.5	464.5	563.3
Road oil	396	459	359	421	386	352	340	237	182	151	165	193
Other finished products	675	704	701	739	792	770	721	545	583	664	778	734
Unfinished gasoline	10,202	9,981	10,037	10,923	10,750	10,285	10,358	10,395	10,033	9,945	9,697	10,363
Other unfinished oils	36,797	35,728	36,166	35,127	35,853	38,364	39,122	39,844	40,428	40,870	40,353	41,074
Total	**247,729**	**245,120**	**239,775**	**234,441**	**230,962**	**228,242**	**227,872**	**229,058**	**231,454**	**234,065**	**231,426**	**229,362**

[1] Subject to revision.

Runs to stills and production at refineries in the United States of the various refined products, 1942–43, by months

[Thousands of barrels, except as otherwise indicated]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1942													
Input:													
Crude petroleum	119, 032	105, 870	110, 725	104, 962	106, 883	105, 376	111, 555	114, 135	113, 474	116, 381	112, 368	113, 342	1, 334, 103
Natural gasoline	5, 351	4, 362	4, 254	3, 966	4, 272	4, 423	4, 577	4, 909	5, 108	5, 455	4, 989	4, 929	56, 595
Total input	124, 383	110, 232	114, 979	108, 928	111, 155	109, 799	116, 132	119, 044	118, 582	121, 836	117, 357	118, 271	1, 390, 698
Output:													
Gasoline	58, 400	49, 688	50, 652	45, 889	46, 975	44, 250	47, 611	49, 488	48, 078	50, 357	48, 538	47, 045	586, 971
Kerosine	6, 634	6, 133	6, 035	5, 529	5, 302	4, 929	5, 134	5, 340	5, 421	5, 907	5, 759	5, 351	67, 474
Distillate fuel oil	16, 902	15, 194	16, 214	14, 002	13, 436	15, 210	16, 149	17, 052	18, 062	18, 858	17, 562	18, 073	196, 714
Residual fuel oil	29, 405	27, 254	28, 095	29, 440	30, 971	28, 352	30, 096	30, 446	30, 402	31, 239	31, 311	31, 890	358, 901
Lubricating oil	3, 497	3, 174	3, 533	3, 438	3, 439	3, 231	3, 133	3, 141	2, 951	3, 057	2, 983	3, 049	38, 626
Wax	197	189	220	186	185	207	181	218	204	269	214	232	2, 502
Coke	699	606	542	457	417	438	505	554	540	615	610	709	6, 692
Asphalt	2, 101	2, 105	2, 355	2, 491	2, 753	2, 848	3, 461	3, 407	3, 475	3, 613	3, 020	3, 002	34, 631
Still gas	6, 889	6, 385	6, 499	6, 305	6, 586	6, 313	6, 789	6, 872	6, 426	6, 764	6, 550	6, 546	78, 924
Wax thousands of pounds	55, 160	52, 920	61, 600	52, 080	51, 800	57, 960	50, 680	61, 040	57, 120	75, 320	59, 920	64, 960	700, 560
Coke thousands of short tons	139. 8	121. 2	108. 4	91. 4	83. 4	87. 6	101. 0	110. 8	108. 0	123. 0	122. 0	141. 8	1, 338. 4
Asphalt do	382. 0	382. 7	428. 2	452. 9	500. 5	517. 8	629. 3	619. 5	631. 8	656. 9	549. 1	545. 8	6, 296. 5
Still gas millions of cubic feet	24, 800	22, 986	23, 396	22, 698	23, 710	22, 727	24, 440	24, 739	23, 134	24, 350	23, 580	23, 566	284, 126
Road oil	435	321	475	450	862	1, 339	1, 132	810	744	515	472	484	8, 039
Other finished products	684	648	743	701	777	745	712	648	608	547	592	712	8, 117
Unfinished gasoline (net)	39	387	[1] 562	146	[1] 475	217	352	334	730	100	39	362	1, 669
Other unfinished oils (net)	[1] 1, 473	[1] 1, 868	[1] 10	[1] 421	[1] 678	935	107	92	294	[1] 215	[1] 572	456	[1] 3, 353
Shortage	[2] 26	16	188	315	605	785	770	642	647	210	279	360	4, 791
Total output	124, 383	110, 232	114, 979	108, 928	111, 155	109, 799	116, 132	119, 044	118, 582	121, 836	117, 357	118, 271	1, 390, 698

See footnotes at end of table.

Runs to stills and production at refineries in the United States of the various refined products, 1942-43, by months—Continued

[Thousands of barrels, except as otherwise indicated]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1943 [3]													
Input:													
Crude petroleum	111,606	101,935	112,013	111,945	115,005	115,984	120,689	126,908	126,088	129,036	126,473	132,056	1,429,738
Natural gasoline	4,317	4,326	4,907	4,986	5,197	5,089	5,161	5,493	5,613	5,564	5,166	5,379	61,198
Total input	115,923	106,261	116,920	116,931	120,202	121,073	125,850	132,401	131,701	134,600	131,639	137,435	1,490,936
Output:													
Gasoline	45,125	41,699	45,001	44,540	47,011	47,915	49,521	52,811	53,647	55,386	54,051	55,718	592,425
Kerosine	5,602	5,852	6,326	6,299	6,511	6,060	5,769	5,394	5,817	5,977	6,138	6,525	72,270
Distillate fuel oil	17,306	16,240	17,288	16,690	16,075	15,261	16,073	18,210	18,523	20,549	19,370	19,931	211,516
Residual fuel oil	32,544	30,799	32,700	34,095	33,732	33,510	36,624	37,418	38,610	34,663	36,649	37,962	417,306
Lubricating oil	2,935	2,780	3,184	3,107	3,281	3,162	3,257	3,296	3,236	3,635	3,589	3,217	38,679
Wax	206	195	233	239	228	216	214	219	222	240	245	240	2,697
Coke	565	467	490	511	525	576	565	608	669	656	682	628	6,942
Asphalt	2,398	2,148	2,657	2,870	3,207	3,516	3,707	3,820	3,644	3,588	3,047	2,560	37,162
Still gas	6,602	6,244	6,737	7,155	7,357	7,439	7,582	7,547	7,459	7,633	7,472	7,528	86,755
Wax.........thousands of pounds	57,680	54,600	65,240	66,920	63,840	60,480	59,920	61,320	62,160	67,200	68,600	67,200	755,160
Coke.........thousands of short tons	113.0	93.4	98.0	102.2	105.0	115.2	113.0	121.6	133.8	131.2	136.4	125.6	1,388.4
Asphalt.........do	436.0	390.5	483.1	521.8	583.1	639.3	674.0	694.5	662.5	652.4	554.0	465.5	6,756.7
Still gas.........millions of cubic feet	23,767	22,478	24,254	25,758	26,485	26,781	27,295	27,169	26,852	27,479	26,899	27,101	312,318
Road oil	224	173	83	186	152	228	282	221	247	238	155	106	2,295
Other finished products	806	707	738	692	662	574	717	769	848	1,089	1,030	1,028	9,660
Unfinished gasoline (net)	848	[1] 221	56	886	[1] 173	[1] 465	73	37	[1] 362	[1] 88	[1] 248	666	1,009
Other unfinished oils (net)	152	[1] 1,173	329	[1] 1,184	581	2,374	650	608	353	278	[1] 933	562	2,597
Shortage	610	351	1,098	845	1,053	707	816	1,443	788	756	392	764	9,623
Total output	115,923	106,261	116,920	116,931	120,202	121,073	125,850	132,401	131,701	134,600	131,639	137,435	1,490,936

[1] Negative quantity; represents net excess rerun over production.
[2] Negative quantity (overage).
[3] Subject to revision.

Runs to stills and production at refineries in the United States of the various refined products, 1942–43, by districts

[Thousands of barrels, except as otherwise indicated]

	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	United States
1942											
Input:											
Crude petroleum	161, 142	57, 392	264, 220	129, 382	68, 378	306, 755	53, 547	28, 654	34, 469	230, 164	1, 334, 103
Natural gasoline	871	511	7, 585	4, 096	6, 312	17, 799	3, 025	1, 379	797	14, 220	56, 595
Total input	162, 013	57, 903	271, 805	133, 478	74, 690	324, 554	56, 572	30, 033	35, 266	244, 384	1, 390, 698
Output:											
Gasoline	61, 135	24, 793	131, 347	64, 946	39, 500	128, 181	23, 182	11, 876	16, 763	85, 248	586, 971
Kerosine	7, 929	3, 640	15, 802	8, 984	3, 015	17, 364	5, 219	2, 460	698	2, 363	67, 474
Distillate fuel oil	31, 132	6, 769	34, 388	18, 344	3, 664	60, 697	9, 428	4, 112	3, 782	24, 398	196, 714
Residual fuel oil	45, 653	9, 498	55, 545	24, 788	16, 586	74, 778	11, 772	6, 734	9, 202	104, 255	358, 901
Lubricating oil	7, 798	6, 417	4, 326	4, 277	260	9, 356	2, 066	1, 220	234	2, 672	38, 626
Wax	763	426	207	207	12	502	305	....	80	....	2, 502
Coke	12	126	4, 236	720	375	708	81	....	188	246	6, 692
Asphalt	4, 495	1, 867	7, 273	2, 896	2, 137	2, 736	2, 859	2, 035	984	7, 349	34, 631
Still gas	10, 425	2, 767	15, 666	7, 127	4, 388	23, 705	2, 807	1, 004	1, 543	9, 492	78, 924
Wax ..... thousands of pounds	213, 640	119, 280	57, 960	57, 960	3, 360	140, 560	85, 400	....	22, 400	....	700, 560
Coke ..... thousands of short tons	2. 4	25. 2	847. 2	144. 0	75. 0	141. 6	16. 2	....	37. 6	49. 2	1, 338. 4
Asphalt ..... do	817. 2	339. 3	1, 322. 4	526. 7	388. 3	497. 6	519. 8	370. 1	178. 9	1, 336. 2	6, 296. 5
Still gas ..... millions of cubic feet	37, 530	9, 961	56, 398	25, 657	15, 797	85, 338	10, 105	3, 614	5, 555	34, 171	284, 126
Road oil	−5	30	1, 169	396	....	48	−1	150	1, 363	4, 889	8, 039
Other finished products	1, 786	447	1, 575	214	236	606	478	86	73	2, 616	8, 117
Unfinished gasoline (net)	[1] 1, 396	32	373	[1] 227	470	1, 503	[1] 87	[1] 9	8	1, 002	1, 669
Other unfinished oils (net)	[1] 7, 311	[1] 15	[1] 488	[1] 926	1, 788	5, 877	[1] 1, 685	31	[1] 140	[1] 484	[1] 3, 353
Shortage	[2] 403	1, 106	386	1, 732	2, 259	[2] 1, 507	148	334	398	338	4, 791
Total output	162, 013	57, 903	271, 805	133, 478	74, 690	324, 554	56, 572	30, 033	35, 266	244, 384	1, 390, 698

See footnotes at end of table.

Runs to stills and production at refineries in the United States of the various refined products, 1942–43, by districts—Continued

[Thousands of barrels, except as otherwise indicated]

	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	United States
1943 [3]											
Input:											
Crude petroleum	194, 219	54, 900	265, 234	124, 167	72, 993	334, 999	57, 137	27, 116	35, 105	263, 868	1, 429, 738
Natural gasoline	732	430	7, 500	5, 160	8, 589	18, 940	4, 089	1, 358	666	13, 725	61, 198
Total input	194, 951	55, 330	272, 734	129, 336	81, 582	353, 939	61, 226	28, 474	35, 771	277, 593	1, 490, 936
Output:											
Gasoline	68, 436	22, 170	126, 142	60, 316	40, 584	133, 622	22, 392	10, 496	16, 484	91, 783	592, 425
Kerosine	7, 561	3, 697	14, 370	8, 470	3, 310	22, 060	6, 303	2, 304	794	3, 401	72, 270
Distillate fuel oil	38, 077	6, 460	34, 631	17, 099	4, 701	64, 506	9, 477	4, 017	3, 667	28, 881	211, 516
Residual fuel oil	56, 004	10, 274	59, 621	24, 969	22, 742	86, 549	12, 768	7, 294	10, 229	126, 856	417, 306
Lubricating oil	7, 205	5, 652	4, 689	4, 451	244	9, 745	1, 945	1, 153	251	3, 344	38, 679
Wax	881	361	231	281	11	511	334		75	12	2, 697
Coke	13	111	4, 250	591	459	896	289		189	144	6, 942
Asphalt	5, 570	1, 787	7, 837	3, 851	2, 258	2, 396	2, 656	1, 961	1, 059	7, 787	37, 162
Still gas	12, 347	2, 847	16, 071	6, 683	3, 911	26, 732	4, 951	1, 189	1, 506	10, 518	86, 755
Wax thousands of pounds	246, 680	101, 080	64, 680	78, 680	3, 080	143, 080	93, 520		21, 000	3, 360	755, 160
Coke thousands of short tons	2. 6	22. 2	850. 0	118. 2	91. 8	179. 2	57. 8		37. 8	28. 8	1, 388. 4
Asphalt do	1, 012. 8	324. 8	1, 425. 0	700. 1	410. 5	435. 6	483. 0	356. 5	192. 6	1, 415. 8	6, 756. 7
Still gas millions of cubic feet	44, 449	10, 249	57, 855	24, 059	14, 080	96, 235	17, 824	4, 280	5, 422	37, 865	312, 318
Road oil	12		41	51		−44	1	21	807	1, 406	2, 295
Other finished products	2, 746	560	1, 403	355	300	1, 494	888	389	99	1, 426	9, 660
Unfinished gasoline (net)	[1] 6	127	[1] 124	209	469	71	150		46	67	1, 009
Other unfinished oils (net)	[1] 4, 531	96	1, 813	[1] 180	519	6, 589	[1] 1, 115	[1] 262	86	[1] 418	2, 597
Shortage	636	1, 188	1, 759	2, 190	2, 074	[2] 1, 188	187	[2] 88	479	2, 386	9, 623
Total output	194, 951	55, 330	272, 734	129, 336	81, 582	353, 939	61, 226	28, 474	35, 771	277, 593	1, 490, 936

[1] Negative quantity; represents net excess rerun over production.
[2] Negative quantity (overage).
[3] Subject to revision.

There were comparatively few changes in the representative prices of refined products during 1943. The price of Regular-Grade gasoline at Oklahoma refineries was 5.94 cents per gallon for the first 7 months of the year and rose to the ceiling price of 6.00 cents per gallon for the last 4 months. The tank-wagon price of kerosine at Chicago remained constant in 1943 at 10.30 cents per gallon. The price of bright stock at Oklahoma refineries, at 22.75 cents per gallon, showed no change during the year. The price of Bunker "C" fuel oil at New York was $1.37 per barrel in January, rose to a maximum of $1.80, and declined to $1.61 per barrel in December. The variations were due primarily to changes in specifications.

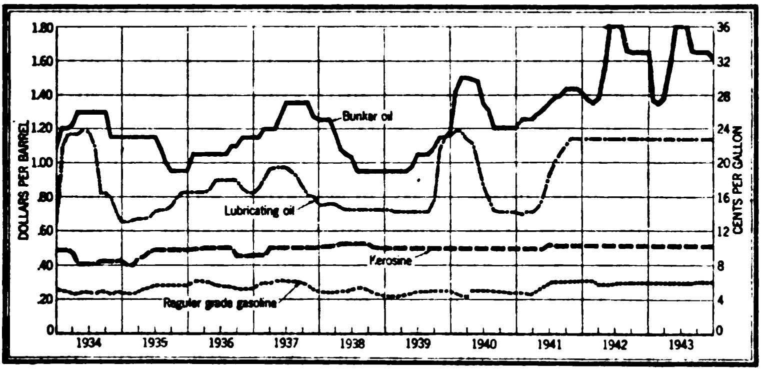

FIGURE 7.—Prices of Bunker "C" fuel oil at New York, bright stock at Oklahoma refineries, tank-wagon price of kerosine at Chicago, and Regular-Grade gasoline at refineries in Oklahoma, 1934–43, by months.

REFINING

The data from the annual survey of refinery capacity as of January 1, 1944, are not available as yet. The principal changes in crude-oil capacity were due to the operation of a larger percentage of existing capacity to meet the expansion in the volume of crude run to stills. Daily average crude run to stills rose from 3,600,000 barrels in January to a peak of 4,260,000 barrels in December. The most important developments in refinery capacity in 1943 were related to the installation of new catalytic cracking units and of equipment to produce 100-octane aviation gasoline.

Summary of refinery capacity in the United States, January 1, 1940–44

Year	Number of refineries				Capacity (barrels per day)			
	Operating	Shut down	Building	Total	Operating	Shut down	Building	Total
1940	461	86	10	557	4, 196, 694	431, 952	92, 567	4, 721, 213
1941	420	136	6	562	4, 180, 588	538, 381	141, 225	4, 860, 194
1942	430	92	1	523	4, 496, 843	459, 756	43, 400	4, 999, 999
1943	386	85	1	472	4, 404, 213	493, 098	195, 100	5, 092, 411
1944[1]								

[1] Not available.

Improvements in refining technique have developed so rapidly that plants become obsolete almost before they are put in operation. Many of these improvements particularly those that can be duplicated most easily, are still unrevealed because of military secrecy. Recent progress includes advancement in catalytic cracking, cyclization superfractionation, and desulfurization.

Whereas thermal cracking is accomplished by heat and pressure alone, catalytic cracking depends on a foreign substance known as a catalyst that modifies the chemical reaction by causing certain elements to join or to separate without the catalyst itself entering into the reaction. Thermal cracking produces a gasoline that is high in olefin content, whereas the yields of catalytic operations are high in aromatics and isoparaffins—hydrocarbons that serve excellently as base stock for aviation gasoline.

This ability to produce products of the high grade demanded by war requirements has caused a rapid development in catalytic cracking during the past 2 years. At the completion of the program some 60 plants will have catalytic cracking facilities compared with 14 in 1941. Three processes are now in operation—the Houdry, the fluid catalyst, and the Thermofor catalytic cracking. All are characterized by the problem of removing coke from the catalyst. The first plant in this country was completed in 1936 and operated with fixed catalyst cases. The first fluid catalyst was put in operation in 1942. The catalyst, in powdered form, moved with the vaporized oil during the reaction and then separated from the oil for regeneration. The Thermofor catalytic cracking (TCC) process, characterized by gravity flow of the catalyst, was put in commercial operation in 1943. The catalyst is lifted to hoppers by elevators, and the activated catalyst flows by gravity to the reaction chamber, from which it is removed by the same means after the reaction is completed. The spent catalyst is then elevated to another hopper, from which it flows by gravity through a Thermofor kiln for regeneration. The adiabatic process, announced in 1943, is an improvement on the original Houdry process, by which a greater yield of gasoline with considerably higher octane rating can be produced.

Improvement in catalysts has progressed with equipment. Early catalysts were natural or treated clays. These gave way to synthetic catalysts, and research has been developing and improving these at a rapid rate. A synthetic catalyst can be produced to emphasize the qualities desired, such as greater porosity, a greater yield of aromatics and other high-octane gasoline, longer life, and freedom from deposition of coke. The bead catalyst was among the synthetic catalysts announced in 1943. It has the advantage of great strength to resist crushing and wear, and a large yield of high-octane gasoline.

Production of aromatic hydrocarbons from naphthas by catalytic cyclization received considerable attention in 1943. The elementary aromatics are benzene, toluene, and the xylenes. Although aromatics constitute a large proportion of the yield of catalytic cracking, an even greater proportion can be obtained by hydroforming and cyclization. Whereas hydroforming converts naphthenes to aromatics by dehydrogenation, cyclization converts to aromatics.

The need for unusually pure hydrocarbons required as raw material for special products, such as toluene, butadiene, and aviation blending compounds, has necessitated much closer control in the separation of the fractions. The process has become known as superfractionation. Superfractionation originated in the natural-gasoline industry for the purpose of separating the light hydrocarbons, and the early process has been expanded to meet the more exacting requirements of present-day needs. Superfractionating equipment consists of towers equipped with bubble plates or trays by means of which the rising vapor bubbles through liquid of a temperature that varies at the different trays, each gaseous constituent condensing at that tray where the liquid in it has the same temperature as the boiling point of the fraction to be extracted. The necessity for purity in some products requires extremely precise fractionation involving the use of 150 plates or more and several towers compared with 30 to 50 plates in the older conventional process.

The utilization of high-sulfur crude oils has been a troublesome problem for refiners. The problem is to overcome the corrosive effect of sulfur compounds on processing equipment and to reduce the sulfur content in finished products to satisfactory limits. The availability of large reserves of such crude oils in West Texas, New Mexico, Wyoming, Montana, and California has led to intensive research to determine their capability of yielding desulfurized virgin distillate suitable for use as aviation base stock.

Aviation gasoline.—The production of all grades of aviation gasoline amounted to about 21 million barrels in 1941 or 3 percent of the total motor-fuel output. Production in 1943 was almost five times as great and represented about 16 percent of the total, which may increase to almost 25 percent in 1944. The continued upward revision of estimated requirements has necessitated construction of new plants and the use of short-cut methods of expanding the output of essential constituents. Even with the new plants coming into operation, it was necessary to relax the rigidity of specifications early in 1944 to obtain enough high-octane fuel. Tetraethyl lead content was increased from 4.0 cc. per gallon to 4.6 cc. January 5, 1944; distillation points also were raised to expand production.

Thirty-two of the new aviation plants were supplying 100-octane gasoline by the end of 1943, and 40 more were scheduled for completion early in 1944.

War requirements have necessitated a double octane index to describe the antiknock quality of aviation fuel—a rich-mixture (3–C) rating in addition to the lean-mixture (1–C) rating previously in use. The rich-mixture rating describes the superior quality of the fuel for take-offs, climbing, sudden loads, and similar circumstances extremely important under combat conditions and not indicated by the ordinary octane rating. The rich-mixture rating is determined in a supercharged knock-test engine by comparing the fuel to be tested with a standard reference fuel. Thus a 130 rich-mixture number indicates that the fuel is 30 percent better than the reference fuel. Specifications for the two upper grades of aviation fuel are 100/130 and 91/96.

Cumene, first produced for aviation-fuel blending in 1942, has been the principal rich-mixture additive. It was being manufactured in substantial quantities in 18 plants in 1943. Other additives about five times as potent as cumene came into use during 1943, and together made possible a surplus of rich-mixture fuel, with the result that by the end of 1943 the emphasis was on the production of lean-mixture rather than rich-mixture fuel.

Quality of gasoline.—As a result of the pressure to increase the output of aviation gasoline, the quality of normal grades began to suffer early in the war, when the octane number was reduced from 72–74 to 71–72 for Regular Grade, and from a minimum of 80 to a minimum of 78 for Premium Grade because of insufficient tetra-ethyl lead. The supply of tetra-ethyl lead, however, improved so that by October 16, 1942, the minimum of 80 octane for Premium-Grade fuel was reinstated. The Bureau of Mines Cooperative Fuel Research Motor-Gasoline Survey for the winter 1942–43 found an average of 79.6 octane for Premium-Grade gasoline and 72.5 octane for Regular-Grade, compared with 80.2 and 74.4 octane, respectively, in the winter 1940–41 survey.

The Ethyl Corporation in January 1943 permitted production of 78 minimum gasoline where production of war material prevented refiners from meeting the 80-octane specification. The Petroleum Administration for War placed a maximum as of November 1, 1943, of 72 octane on Regular-Grade gasoline and 76 octane on Premium-Grade, and the Ethyl Corporation placed a minimum of 75 octane on Premium-Grade. Thus the octane rating of Premium-Grade gasoline at the end of 1943 was but little above the 74.4-octane average found for Regular Grade in the winter 1941–42 survey. Furthermore, the volatility of the gasoline was reduced by the same instructions from the Petroleum Administration for War at the time of the year when it is usually raised. These reductions in motor-fuel quality were made not only to foster the production of aviation fuel but also to provide 80-octane fuel for all military ground vehicles in foreign zones.

MOTOR FUEL

The total demand for motor fuel reflects the combined trends of the growing requirements of our armed forces, the reduction in less essential civilian consumption, and changes in exports. The most significant factor in 1942 was the rationing of gasoline for civilian automotive use, which caused a sharp decline in total gasoline demand, disturbed the balance of refinery operations, and reduced the yield of gasoline from crude. The major trend in 1943 was the expansion in war requirements to an amount far greater than had been anticipated. Total demand and yield from crude fell to the lowest levels in the first quarter of the year and then began to rise sharply.

The total demand for motor fuel declined from 695 million barrels in 1941 to 624 million in 1942 and to 622 million in 1943. The quarterly trend of demand in 1943 compared with 1942 shows a decrease of over 27 million barrels in the first quarter, a gain of 1 million barrels in the second quarter, and increases of 10 million and 15 million barrels, respectively, in the third and fourth quarters. After the first quarter the rise in war requirements more than offset any further declines in civilian consumption. Total demand in 1944 probably will set a new record and materially exceed even the previous peak of 1941.

Exports.—Exports of gasoline, including shipments to noncontiguous Territories, were reduced to about 25 million barrels in 1940. After a small gain in 1941, they rose to 35 million barrels in 1942 and to over 51 million in 1943. Virtually all the increase in the last 3 years can be attributed to larger shipments of aviation gasoline. The adaptability of refinery equipment and the varied materials available as blending agents have made the United States the major source of 100-octane gasoline, and exports should continue to increase as military operations expand.

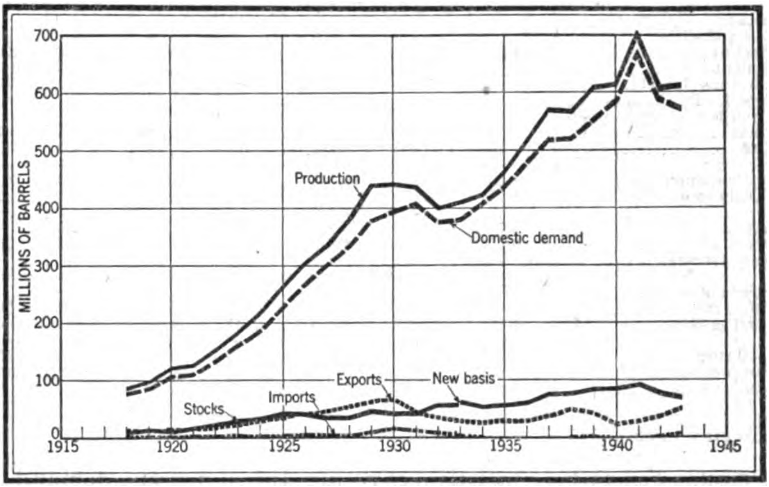

FIGURE 8.—Trends of production, domestic demand, exports, imports, and stocks of motor fuel in the United States, 1918–43.

Comparative analyses of statistics for motor fuel in the United States in 1943, by months[1]

[Thousands of barrels]

	1943						
	Jan.	Feb.	March	April	May	June	July
Production:							
Refinery gasoline:							
Cracked	23,391	21,947	23,297	24.264	25,037	24,763	26,433
Straight-run	17,417	15,426	16,797	15,290	16,777	18 063	17,927
Natural gasoline, etc	7,160	6,640	7.357	7,171	7,290	7.052	7,287
Less L. P. G. sales and transfers of cycle products	932	933	998	900	822	848	803
Benzol	200	200	200	200	200	200	200
Total production	47,236	43,280	46,653	46.025	48,482	49,230	51,044
Daily average	1,524	1,546	1,505	1,534	1,564	1,641	1,647
Imports	....	....	2	110	85	1,400	1,049
Exports	3,131	2.326	2,873	3,111	4,108	4,222	6,113
Daily average	101	83	93	104	133	141	197
Stocks, end of period:							
Finished gasoline	78,475	82,867	84,077	78.653	73,137	67,345	62,791
Natural gasoline	4,904	4,996	5,462	5,425	5,407	5,179	5,028
Total stocks	83,379	87,863	89,539	84,078	78,544	72.524	67.819
Domestic demand	36,130	36,470	42,106	48.485	49,993	52,428	50,685
Daily average	1,165	1,303	1,358	1,616	1,613	1,748	1,635

[1] Subject to revision.

Comparative analyses of statistics for motor fuel in the United States in 1943, by months [1]—Continued

[Thousands of barrels]

	1943—Continued						1942 (total)
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Production:							
Refinery gasoline:							
Cracked	27,940	27,477	30,099	29,551	30,255	314,454	296,928
Straight-run	19,378	20,557	19,723	19,334	20,084	216,773	233,448
Natural gasoline, etc	7,401	7,502	7,834	7,687	7,798	88,179	83,322
Less L. P. G. sales and transfers of cycle products	888	889	1,040	1,080	1,140	11,273	7.195
Benzol	200	200	200	200	200	2,400	2,397
Total production	54,031	54,847	56.816	55,692	57,197	610,533	608.900
Daily average	1,743	1,828	1.833	1,856	1,845	1,673	1,668
Imports	1,703	176	898	177	136	5,736	115
Exports	5,975	6,972	4,816	4,095	3,639	51,381	35,097
Daily average	193	232	155	137	117	141	96
Stocks, end of period:							
Finished gasoline	60,664	59,186	59,100	59,854	64,964	64,964	70,772
Natural gasoline	4.893	4,723	4,465	4,645	4,541	4,541	4,632
Total stocks	65.557	63,909	63.565	64,499	69.505	69.505	75.404
Domestic demand	52,021	49,699	53,242	50,840	48,688	570.787	589,110
Daily average	1,678	1,657	1,717	1,695	1,571	1,564	1,614

[1] Subject to revision.

Domestic demand.—Statistics covering the domestic demand for motor fuel include consumption for all purposes in continental United States and all shipments consigned to our armed forces abroad. The trend of domestic demand is a resultant of the decline in civilian consumption and the increase in total military use. Without accurate data on the distribution of military consumption at home and abroad, it is very difficult to determine total consumption in continental United States, particularly by States. The distribution of total civilian consumption, however, is indicated by State data relating to the volume of taxable gasoline.

Distribution of domestic motor-fuel demand, 1925–43 [1]

[Thousands of barrels of 42 gallons]

Year	Motor-fuel demand		Busses	Passenger cars			Trucks		
	Total	Automotive		Highway	City	Total	Highway	City	Total
1925	226,329	201.433	3,391	80,653	74.285	154,938	8,466	34.638	43,104
1926	264.391	235,308	4,649	93,666	87,573	181,239	10.131	39.289	49,420
1927	299.818	266.839	5,458	105,553	100.430	205.983	12.068	43,329	55.397
1928	332,033	295,509	7,248	115.422	112,075	227,497	14,295	46.469	60,764
1929	375,999	334.649	9,394	128,943	127,956	256,899	17,417	50,929	68.346
1930	394,800	351,372	10,885	133,454	136,893	270,347	19.765	50.375	70,140
1931	403.418	350.042	11,468	134,276	142,552	276.828	22,132	48 614	70,746
1932	373,900	332,771	10,530	134.998	122.705	257,703	42,235	22,303	64,538
1933	377,003	335,533	10,110	135.895	122,283	258,178	43.088	24,157	67,245
1934	407,106	362.324	9.640	146.283	130.403	276.686	47,693	28.305	75.998
1935	434,810	386.981	9,750	153,985	138.641	292,626	51.606	32,999	84.605
1936	481,606	428.629	10.560	167.645	153.868	321,513	58,112	38,444	96,556
1937	519,352	462,223	11,450	177,840	163,270	341,110	63,324	46,339	109,663
1938	523,003	465.473	11,765	179,387	163.124	342,511	61,079	50,118	111,197
1939	555,509	494,403	12,300	186,867	171,977	358,844	66.237	57,022	123,259
1940	589,490	524,646	13,600	195,823	180,789	376,612	69.921	64.513	134.434
1941	667,505	583,957	15.000	221,758	202,952	424,710	74.100	70.147	144,247
1942 [1]	589,110	474,625	17,600	176,371	151,591	327,962	67,119	61,944	129 063
1943 [2]	570,787	384,332	18,200	131,874	112,754	244,628	63,392	58,112	121,504

[1] Revised.

[2] Subject to revision.

The total domestic demand for motor fuel, including shipments to our armed forces abroad, declined from 589 million barrels in 1942 to 571 million in 1943. Automotive consumption is estimated at about 475 million barrels in 1942 and 384 million in 1943. The domestic demand for motor fuel in 1942 and 1943 was more complex than in any previous period in the history of Bureau of Mines statistics. Nonhighway gasoline consumption and losses, which in recent normal years have averaged about 11 percent of the domestic demand, were swelled by our military requirements at home and abroad to 33 percent of the total in 1943.

The automotive use of gasoline was affected by variations in rationing for the various types of vehicles and for different regions. Consumption of gasoline by commercial vehicles declined only moderately, but that by passenger cars was curtailed severely by rationing. Most of the reduction in rural-highway truck traffic was in the single units. Miles traveled by combination units declined but little, resulting in fewer miles per gallon for trucks, with the consequence that gasoline consumption by trucks was reduced less than the reduction in traffic.

Gasoline consumption in the Eastern Seaboard States, already severely curtailed by rationing, underwent further restriction toward the end of 1942, when military requirements depleted stocks in that area and led to a ban on pleasure driving from January 7 to March 3. State tax statistics indicate that automotive gasoline consumption in this area dropped from 12.4 million barrels in November 1942 to 10.7 million in December 1942 and to 8.9 million in January 1943. Relaxation of the pleasure-driving ban on March 3 permitted an increase; but the ban, again instituted on May 20 in the critical shortage area, which included the Atlantic Seaboard States north of the Carolinas, kept gasoline consumption low during the summer until the cancellation of the ban on September 1, in which month consumption in this area reached its peak for the year.

The institution of rationing in the remainder of the country on December 1, 1942, caused automotive demand for motor fuel in that area to drop from 29.4 million barrels in November 1942 to 16.5 million in December 1942. Although automobile operation was reduced sharply, much of this drop in demand was caused by users accumulating stocks in anticipation of rationing, followed by a lack of buying until the surplus stocks were used. Recovery was rapid, consumption reaching a peak in July 1943.

A comprehensive survey of truck traffic, published by the Public Roads Administration in 1943, indicates that the proportion of trucks on highways has increased at a greater rate than the Bureau had estimated from toll-facility statistics. The estimated distribution of motor fuel used on rural highways has been based upon studies over a period of years by the Public Roads Administration on miles traveled, miles per gallon, and other traffic data supplemented by annual statistics gathered by the Bureau of Mines on traffic over toll and other measuring facilities. The distribution of motor fuel used on city streets has been based upon traffic surveys in the various cities, with other traffic data. The figures presented herewith have been revised in accordance with the findings in the truck survey mentioned above.

Motor-fuel consumption per motor-vehicle unit in use on July 1, 1939–43 [1]

Year	Passenger-cars			Trucks		
	Consumption (thousands of barrels)	Number of vehicles	Consumption per unit (barrels)	Consumption (thousands of barrels)	Number of vehicles	Consumption per unit (barrels)
1939	358,844	24,342,900	14.74	123,259	4,340,600	28.40
1940 [2]	376,612	25,385,900	14.84	134,434	4,531,700	29.67
1941 [2]	424,710	27,709,200	15.33	144,247	4,788,300	30.12
1942 [2]	327,962	26,946,600	12.17	129,063	4,801,400	26.88
1943 [2]	244,628	25,127,800	9.74	121,504	4,633,000	26.23

[1] Excludes gasoline consumed by busses and for nonautomotive uses.
[2] Subject to revision.

Production.—Motor-fuel output showed a small gain—from 608,900,000 barrels in 1942 to 610,533,000 in 1943. The production in 1943 comprised 216,773,000 barrels of straight-run gasoline, 314,454,000 barrels of cracked gasoline, 2,400,000 barrels of benzol, and 76,906,000 barrels of natural gasoline and cycle products. The production of cracked gasoline increased by almost 18 million barrels, the production of straight-run gasoline declined by about 17 million barrels, and the production of natural gasoline for motor fuel gained about 1 million barrels.

Yields.—The yield of gasoline from crude petroleum declined from 44.2 percent in 1941 to 39.8 percent in 1942 and 37.1 percent in 1943. This reduction in gasoline yield reflects the decline in gasoline demand due to the curtailment of civilian consumption and the early rise in fuel-oil requirements for war-plant and naval purposes. The yield of gasoline was 36.5 percent in January 1943, declined to a low of 35.3 percent in April, and had risen to 38.7 percent by November. With the continued sharp increase in military requirements, a further substantial increase in the gasoline yield may be expected in 1944. The yield of cracked gasoline declined from 22.3 percent in 1942 to 22.0 percent in 1943, and the yield of straight-run fell from 17.5 percent to 15.1 percent.

Production of gasoline in the United States in 1943, by methods of manufacture, districts, and months [1]

[Thousands of barrels]

Method and district	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cracked:													
East Coast	3, 397	3, 115	3, 304	3, 456	3, 582	3, 573	4, 030	4, 316	4, 469	4, 780	4, 807	4, 866	47, 695
Appalachian	1, 110	1, 121	1, 148	1, 105	1, 172	1, 122	1, 128	1, 330	1, 360	1, 279	1, 083	1, 299	14, 257
Indiana, Illinois, Kentucky, etc	5, 439	4, 945	5, 434	5, 500	5, 638	5, 252	6, 232	6, 351	5, 621	6, 218	5, 996	6, 182	68, 808
Oklahoma, Kansas, and Missouri	2, 181	1, 974	2, 336	2, 306	2, 413	2, 633	2, 651	2, 674	2, 670	2, 941	2, 913	2, 603	30, 295
Texas Inland	1, 186	1, 075	1, 065	1, 082	1, 007	1, 189	1, 166	1, 239	1, 285	1, 319	1, 273	1, 322	14, 208
Texas Gulf Coast	5, 317	5, 260	5, 564	6, 477	6, 534	6, 552	6, 501	6, 719	6, 666	7, 880	7, 227	7, 901	78, 598
Louisiana Gulf Coast	901	814	899	922	941	888	839	1, 385	1, 396	1, 343	1, 493	1, 252	13, 073
Arkansas and Louisiana Inland	297	246	236	251	283	256	313	273	335	269	286	318	3, 363
Rocky Mountain	603	616	503	528	609	560	627	720	679	650	724	593	7, 412
California	2, 960	2, 781	2, 808	2, 637	2, 858	2, 738	2, 946	2, 933	2, 996	3, 420	3, 749	3, 919	36, 745
Total cracked	23, 391	21, 947	23, 297	24, 264	25, 037	24, 763	26, 433	27, 940	27, 477	30, 099	29, 551	30, 255	314, 454
Percent yield [2]	21. 0	21. 5	20. 8	21. 7	21. 8	21. 3	21. 9	22. 0	21. 8	23. 3	23. 4	22. 9	22. 0
Straight-run:													
East Coast	1, 459	1, 286	1, 597	1, 725	1, 717	1, 390	1, 513	1, 691	2, 093	1, 761	1, 891	1, 886	20, 009
Appalachian	686	557	661	668	629	616	602	624	583	601	679	577	7, 483
Indiana, Illinois, Kentucky, etc	4, 256	3, 553	3, 493	3, 251	3, 797	4, 305	4, 240	4, 490	4, 764	4, 560	4, 539	4, 586	49, 834
Oklahoma, Kansas, and Missouri	2, 070	1, 996	1, 862	1, 799	2, 013	2, 105	2, 096	2, 203	2, 338	2, 178	1, 997	2, 195	24, 852
Texas Inland	1, 577	1, 165	1, 233	1, 271	1, 455	1, 465	1, 542	1, 576	1, 503	1, 716	1, 527	1, 757	17, 787
Texas Gulf Coast	2, 859	2, 370	3, 020	1, 957	2, 266	2, 579	2, 649	3, 425	3, 699	3, 722	3, 972	3, 566	36, 084
Louisiana Gulf Coast	349	355	380	371	525	416	568	474	429	382	436	545	5, 230
Arkansas and Louisiana Inland	441	439	493	457	487	453	477	494	547	480	511	496	5, 775
Rocky Mountain	754	578	657	665	634	756	648	646	791	693	770	814	8, 406
California	2, 966	3, 127	3, 401	3, 126	3, 254	3, 978	3, 592	3, 755	3, 810	3, 630	3, 012	3, 662	41, 313
Total straight-run	17, 417	15, 426	16, 797	15, 290	16, 777	18, 063	17, 927	19, 378	20, 557	19, 723	19, 334	20, 084	216, 773
Percent yield [2]	15. 6	15. 2	15. 0	13. 6	14. 6	15. 6	14. 8	15. 3	16. 3	15. 3	15. 3	15. 2	15. 2
Total production, including natural gasoline:													
East Coast	4, 942	4, 426	4, 983	5, 241	5, 340	4, 970	5, 642	6, 141	6, 570	6, 572	6, 732	6, 877	68, 436
Appalachian	1, 839	1, 719	1, 849	1, 808	1, 829	1, 767	1, 760	1, 982	1, 980	1, 923	1, 796	1, 918	22, 170
Indiana, Illinois, Kentucky, etc	10, 207	9, 152	9, 439	9, 344	10, 084	10, 126	11, 073	11, 509	11, 124	11, 487	11, 172	11, 425	126, 142
Oklahoma, Kansas, and Missouri	4, 602	4, 403	4, 582	4, 526	4, 801	5, 155	5, 158	5, 317	5, 436	5, 603	5, 403	5, 330	60, 316
Texas Inland	3, 196	2, 935	2, 973	3, 057	3, 129	3, 493	3, 399	3, 602	3, 632	3, 838	3, 528	3, 802	40, 584
Texas Gulf Coast	9, 559	8, 799	10, 298	10, 076	10, 550	10, 759	10, 753	11, 758	12, 053	13, 250	12, 711	13, 056	133, 622
Louisiana Gulf Coast	1, 593	1, 471	1, 576	1, 589	1, 763	1, 641	1, 803	2, 224	2, 188	2, 109	2, 307	2, 128	22, 392
Arkansas and Louisiana Inland	863	784	825	837	869	812	919	885	1, 000	857	902	943	10, 496
Rocky Mountain	1, 438	1, 263	1, 209	1, 232	1, 274	1, 348	1, 306	1, 392	1, 525	1, 439	1, 591	1, 467	16, 484
California	6, 886	6, 747	7, 267	6, 830	7, 372	7, 844	7, 708	8, 001	8, 139	8, 308	7, 909	8, 772	91, 783
Total United States: 1943	45, 125	41, 699	45, 001	44, 540	47, 011	47, 915	49, 521	52, 811	53, 647	55, 386	54, 051	55, 718	592, 425
1942	58, 400	49, 688	50, 652	45, 889	46, 975	44, 250	47, 611	49, 488	48, 078	50, 357	48, 538	47, 045	586, 971

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[1] Subject to revision.

[2] Based upon crude runs to stills.

Prices.—There were only minor changes in the representative prices for gasoline in 1943. Office of Price Administration Schedule 88, signed February 2, 1942, had provided that prices for petroleum products in effect October 1, 1941, should be ceiling prices, except at service stations.

The average group 3 refinery price for gasoline, with a ceiling price of 6.00 cents per gallon, was 5.96 cents per gallon in 1943 compared with 5.91 cents in 1942. The average remained at 5.94 cents from September 1942 through July 1943 and rose to 5.96 cents in August 1943 and to 6.00 cents in September, remaining at that level for the rest of the year.

The average 50-city dealers' net price for gasoline was 10.45 cents per gallon in 1943 compared with 10.44 cents in 1942. It gradually rose from 10.37 cents in January 1943 to 10.51 cents at the end of the year.

The average 50-city service-station price, including State and local taxes, was 18.93 cents per gallon in 1942 and 19.03 cents in 1943. This price shows wider fluctuations because of the more varied local conditions involved.

Average monthly prices of gasoline in the United States, 1942–43, in cents per gallon

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1942													
Monthly average at refineries in Oklahoma, 72–74 octane [1]	6.19	6.16	5.77	5.72	5.76	5.81	5.87	5.92	5.94	5.94	5.94	5.94	5.91
Average of 50 cities on 1st of month: [2]													
Dealer's net	9.98	10.16	10.10	10.25	10.40	10.38	11.31	11.26	10.33	10.33	10.37	10.37	10.44
Service station (including State and local taxes)	18.41	18.59	18.54	18.76	18.87	18.87	19.86	19.79	18.86	18.85	18.87	18.91	18.93
1943													
Monthly average at refineries in Oklahoma, 72-74 octane [1]	5.94	5.94	5.94	5.94	5.94	5.94	5.94	5.96	6.00	6.00	6.00	6.00	5.96
Average of 50 cities on 1st of month: [2]													
Dealer's net	10.37	10.39	10.40	10.40	10.40	10.40	10.50	10.46	10.51	10.51	10.51	10.51	10.45
Service station (including State and local taxes)	18.93	18.97	18.98	18.97	18.98	18.99	19.08	19.05	19.05	19.10	19.10	19.10	19.03

[1] National Petroleum News.
[2] American Petroleum Institute: compiled by The Texas Co.

Stocks.—Stocks of finished and unfinished gasoline continued to decline in 1943. Such stocks amounted to 93.9 million barrels at the end of 1941, fell to 80.1 million at the end of 1942, and were reduced to 75.3 million barrels on December 31, 1943. Stocks of finished gasoline were reduced by 5.8 million barrels in 1943 compared with a decline of 15.4 million in 1942. The largest reductions in 1943 were in the California and Texas Gulf districts.

Gasoline stocks are computed in terms of days' supply by dividing the stocks at the end of the month by the daily average total demand (domestic demand plus exports) for the succeeding month. Upon this basis, the number of days' supply represented by finished-gasoline stocks on December 31 was 55.9 days at the end of 1942 compared with 38.0 days at the end of 1943. This decline in days' supply is due, in part, to the increasing military consumption of gasoline and the fact that stocks in the custody of the Army or Navy are not included in the published figures.

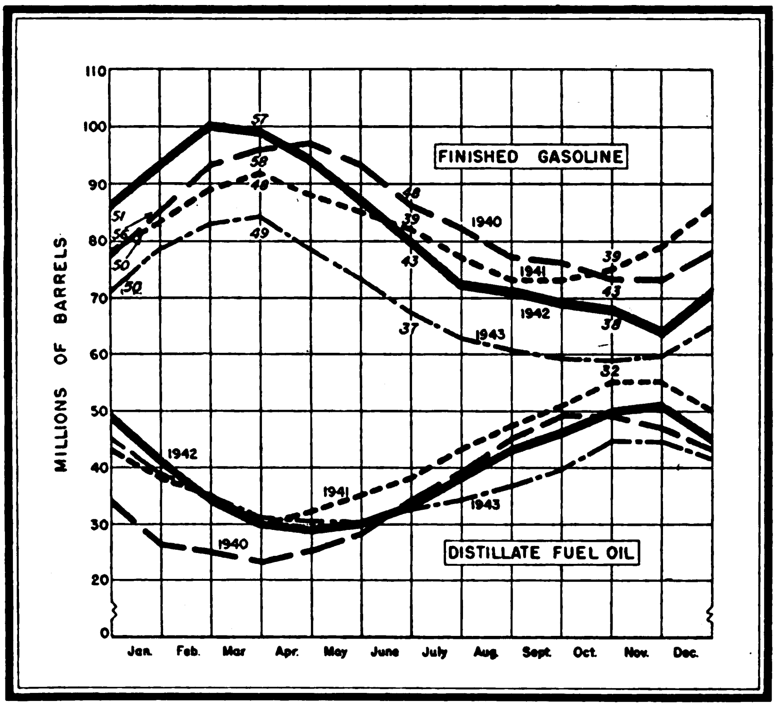

FIGURE 9.—Stocks of finished gasoline in the United States, 1940–43, by months, with figures representing days' supply at certain periods; also stocks of distillate fuel oil, 1940–43, by months.

Days' supply [1] of motor fuel on hand in the United States at end of month, 1941–43

Month	1941			1942			1943 [2]		
	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel
January	53.0	3.5	56.5	58.6	3.0	61.6	56.6	3.6	60.2
February	53.5	3.2	56.7	57.9	3.0	60.9	57.1	3.5	60.6
March	47.8	2.8	50.6	56.8	3.2	60.0	48.9	3.2	52.1
April	44.4	2.8	47.2	52.8	3.4	56.2	45.1	3.1	48.2
May	42.5	2.9	45.4	49.0	3.7	52.7	38.7	2.9	41.6
June	39.0	3.0	42.0	42.9	3.5	46.4	36.8	2.8	39.6
July	36.2	3.0	39.2	43.0	3.9	46.9	33.6	2.7	36.3
August	35.2	3.0	38.2	41.2	3.7	44.9	32.1	2.6	34.7
September	36.4	2.7	39.1	39.8	3.5	43.3	31.6	2.5	34.1
October	38.8	2.5	41.3	37.6	3.0	40.6	32.3	2.4	34.7
November	42.6	2.4	45.0	46.6	3.6	50.2	35.5	2.7	38.2
December	51.0	2.6	53.6	55.9	3.7	59.6	38.0	2.7	40.7

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[1] Stocks divided by the daily average total demand (domestic demand plus exports) for succeeding month.

[2] Subject to revision.

Stocks of gasoline in the United States in 1943, by districts and months [1]

[Thousands of barrels]

District	January 31	February 28	March 31	April 30	May 31	June 30	July 31	August 31	September 30	October 31	November 30	December 31
Finished gasoline: [2]												
East Coast	10, 117	9, 828	9, 296	8, 453	8, 584	9, 367	8, 588	8, 903	8, 477	9, 455	9, 866	10, 556
Appalachian	2, 462	2, 601	2, 326	2, 222	2, 101	1, 943	1, 865	2, 025	2, 071	2, 138	2, 217	2, 489
Indiana, Illinois, Kentucky, etc.	17, 042	18, 728	19, 313	18, 028	17, 268	15, 088	13, 888	13, 336	13, 209	13, 310	13, 535	14, 850
Oklahoma, Kansas, and Missouri	6, 760	6, 996	7, 290	6, 383	5, 928	5, 693	5, 302	5, 268	5, 403	5, 645	6, 157	6, 170
Texas Inland	2, 519	2, 772	2, 627	2, 390	2, 079	1, 809	1, 655	1, 803	1, 966	1, 971	1, 882	2, 369
Texas Gulf Coast	15, 422	16, 133	17, 114	16, 000	12, 777	10, 603	10, 303	9, 492	9, 417	9, 396	9, 645	10, 799
Louisiana Gulf Coast	4, 113	4, 384	4, 505	3, 882	3, 782	2, 567	2, 592	2, 748	3, 075	2, 833	2, 803	2, 970
Arkansas and Louisiana Inland	1, 890	2, 002	1, 929	1, 863	2, 099	2, 016	1, 973	1, 943	2, 095	1, 961	1, 912	1, 883
Rocky Mountain	1, 814	2, 103	2, 163	2, 050	1, 730	1, 606	1, 356	1, 065	1, 024	953	1, 177	1, 372
California	16, 336	17, 320	17, 514	17, 382	16, 789	16, 653	15, 269	14, 081	12, 449	11, 438	10, 660	11, 506
Total finished gasoline	78, 475	82, 867	84, 077	78, 653	73, 137	67, 345	62, 791	60, 664	59, 186	59, 100	59, 854	64, 964
Unfinished gasoline:												
East Coast	1, 068	1, 099	1, 207	1, 358	1, 019	1, 118	1, 144	1, 233	1, 223	1, 209	1, 100	1, 350
Appalachian	333	303	307	280	279	287	261	269	282	308	359	433
Indiana, Illinois, Kentucky, etc.	977	869	1, 001	971	1, 063	1, 020	969	829	880	793	758	742
Oklahoma, Kansas, and Missouri	332	264	281	424	481	492	526	552	507	552	589	627
Texas Inland	221	360	343	398	379	357	437	459	387	254	281	324
Texas Gulf Coast	3, 336	3, 327	3, 076	2, 835	2, 764	2, 529	2, 666	2, 681	2, 714	2, 647	2, 775	2, 974
Louisiana Gulf Coast	348	377	352	420	389	435	400	418	417	524	491	514
Arkansas and Louisiana Inland	6	4	4	4	3	3	4	3	2	4	5	3
Rocky Mountain	86	86	109	116	102	107	109	115	101	110	107	134
California	3, 495	3, 292	3, 357	4, 117	4, 271	3, 937	3, 842	3, 836	3, 520	3, 544	3, 232	3, 262
Total unfinished gasoline	10, 202	9, 981	10, 037	10, 923	10, 750	10, 285	10, 358	10, 395	10, 033	9, 945	9, 697	10, 363
Total finished and unfinished:												
East Coast	11, 185	10, 927	10, 503	9, 811	9, 603	10, 485	9, 732	10, 136	9, 700	10, 664	10, 966	11, 906
Appalachian	2, 795	2, 904	2, 633	2, 502	2, 380	2, 230	2, 126	2, 294	2, 353	2, 446	2, 576	2, 922
Indiana, Illinois, Kentucky, etc.	18, 019	19, 597	20, 314	18, 999	18, 331	16, 108	14, 857	14, 165	14, 089	14, 103	14, 293	15, 592
Oklahoma, Kansas, and Missouri	7, 092	7, 260	7, 571	6, 807	6, 409	6, 185	5, 828	5, 820	5, 910	6, 197	6, 746	6, 797
Texas Inland	2, 740	3, 132	2, 970	2, 788	2, 458	2, 166	2, 092	2, 262	2, 353	2, 225	2, 163	2, 693
Texas Gulf Coast	18, 758	19, 460	20, 190	18, 835	15, 541	13, 132	12, 969	12, 173	12, 131	12, 043	12, 420	13, 773
Louisiana Gulf Coast	4, 461	4, 761	4, 857	4, 302	4, 171	3, 002	2, 992	3, 166	3, 492	3, 357	3, 294	3, 484
Arkansas and Louisiana Inland	1, 896	2, 006	1, 933	1, 867	2, 102	2, 019	1, 977	1, 946	2, 097	1, 965	1, 917	1, 886
Rocky Mountain	1, 900	2, 189	2, 272	2, 166	1, 832	1, 713	1, 465	1, 180	1, 125	1, 063	1, 284	1, 506
California	19, 831	20, 612	20, 871	21, 499	21, 060	20, 590	19, 111	17, 917	15, 969	14, 982	13, 892	14, 768
Total United States: 1943	88, 677	92, 848	94, 114	89, 576	83, 887	77, 630	73, 149	71, 059	69, 219	69, 045	69, 551	75, 327
1942	101, 356	108, 452	106, 844	101, 909	94, 681	87, 517	79, 446	79, 526	78, 146	76, 622	73, 216	80, 126

[1] Subject to revision.

[2] Includes stocks of finished gasoline at refineries, bulk terminals, and in pipe lines.

Production and consumption by States.—The refinery production of gasoline rose from 586,971,000 barrels in 1942 to 592,425,000 barrels in 1943. Texas produced the largest amount, with 174,206,000 barrels or about 29 percent of the total in 1943. California, the second State in importance, produced 91,783,000 barrels or over 15 percent of the total. In general, production increased in the coastal States, owing to the concentration of production for war purposes, and declined in the interior States.

The lack of information on military consumption at home and abroad makes it extremely difficult to compute total consumption of gasoline by States. Such data are ordinarily compiled from the State tax records. Gasoline moving in military custody is seldom recorded by State inspection agencies. The problem is complicated further by the movement of large quantities to our armed forces abroad through the principal seaboard States.

Production and consumption of gasoline in the United States, 1941–43, by States

[Thousands of barrels]

State	1941		1942		1943[1]	
	Production	Consumption[2]	Production	Consumption[2]	Production	Consumption[2]
Alabama	(3)	7,819	(3)	7,376	(3)	6,223
Arizona	--------	8,051	--------	8,029	--------	8,043
Arkansas	4,044	5,340	4,033	4,923	3,392	4,273
California	[4] 85,734	51,251	[4] 85,248	53,220	[4] 91,783	59,367
Colorado	2,334	6,358	2,312	5,832	2,215	5,744
Connecticut	--------	10,035	--------	8,035	--------	6,200
Delaware	--------	1,622	--------	1,300	--------	1,144
District of Columbia	--------	4,561	--------	3,565	--------	2,513
Florida	--------	11,326	--------	10,503	--------	8,726
Georgia	[5] 4,983	10,713	[5] 3,104	9,096	[5] 4,289	8,308
Idaho	(6)	2,786	(6)	2,526	(6)	2,263
Illinois	[7] 49,377	38,987	[7] 46,825	33,707	[7] 43,646	27,729
Indiana	43,704	19,564	39,017	17,658	39,816	16,013
Iowa	--------	14,578	--------	12,951	--------	11,534
Kansas	[8] 37,434	12,872	[8] 33,878	11,600	[8] 30,924	10,407
Kentucky	[9] 8,523	7,939	[9] 7,949	6,698	[9] 6,928	5,650
Louisiana	[3] 30,300	8,179	[3] 31,024	7,181	[3] 29,505	7,198
Maine	--------	4,138	--------	3,188	--------	2,660
Maryland	(5)	8,703	(5)	7,463	(5)	6,448
Massachusetts	[10] 5,791	19,155	[10] 5,023	14,454	[10] 5,713	11,648
Michigan	11,180	33,149	11,073	28,613	10,427	23,306
Minnesota	(7)	14,481	(7)	13,030	(7)	10,535
Mississippi	(3)	6,163	(3)	6,079	(3)	5,588
Missouri	(8)	18,472	(8)	15,336	(8)	12,426
Montana	4,293	3,533	4,245	3,022	4,264	2,628
Nebraska	(8)	5,989	(8)	5,593	(8)	5,129
Nevada	--------	1,102	--------	1,160	--------	1,007
New Hampshire	--------	2,582	--------	1,847	--------	1,304
New Jersey	28,312	23,838	19,677	19,241	20,863	15,806
New Mexico	1,193	2,909	1,473	2,349	1,558	2,371
New York	9,044	48,797	8,220	37,746	7,323	30,202
North Carolina	--------	12,923	--------	10,132	--------	9,118
North Dakota	--------	3,947	--------	3,928	--------	3,671
Ohio	34,804	39,031	34,692	35,061	32,689	29,782
Oklahoma	34,190	11,368	31,071	10,067	29,392	9,527
Oregon	--------	7,230	--------	6,662	--------	6,080
Pennsylvania	51,431	40,594	39,165	33,073	42,588	25,386
Rhode Island	(10)	3,507	(10)	2,839	(10)	2,465
South Carolina	(5)	6,555	(5)	5,189	(5)	4,492

See footnotes at end of table.

Production and consumption of gasoline in the United States, 1941–43, by States—Continued

[Thousands of barrels]

State	1941		1942		1943[1]	
	Production	Consumption[2]	Production	Consumption[2]	Production	Consumption[2]
South Dakota	(8)	3,634	(8)	3,419	(8)	3,114
Tennessee	(9)	9,186	(9)	8,591	(9)	7,575
Texas	212,347	39,839	167,681	41,453	174,206	62,494
Utah	(6)	2,753	(6)	2,667	(6)	2,432
Vermont		1,790		1,252		980
Virginia		11,842		9,596		9,151
Washington	(4)	10,536	(4)	10,410	(4)	9,598
West Virginia	2,317	5,719	2,529	4,664	2,466	3,627
Wisconsin	(7)	15,148	(7)	13,606	(7)	11,084
Wyoming	[6] 9,775	1,882	[6] 8,732	1,471	[6] 8,438	1,261
Total United States	671,110	637,506	586,971	562,461	592,425	519,220

[1] Subject to revision.

[2] American Petroleum Institute.

[3] Alabama and Mississippi included with Louisiana.

[4] Washington included with California.

[5] Maryland and South Carolina included with Georgia.

[6] Idaho and Utah included with Wyoming.

[7] Minnesota and Wisconsin included with Illinois.

[8] Missouri, Nebraska, and South Dakota included with Kansas.

[9] Tennessee included with Kentucky.

[10] Rhode Island included with Massachusetts.

Distribution.—The transportation and marketing of motor fuel have been altered radically by war conditions. The first major change resulted from the decline in the tanker movement between Gulf and East Coast ports and the expansion in overland tank-car and pipe-line shipments. Progressive restrictions on civilian consumption have reduced the volume of private automotive demand to about two-thirds normal. The rise in military requirements has been offsetting this loss, so that total demand in 1944 may exceed the former peak of 1941. This major shift from civilian to war uses has changed the whole normal system of distribution.

Motor fuel delivered by pipe lines rose from 125 million barrels in 1942 to almost 204 million in 1943. Deliveries in January 1943 amounted to about 10 million barrels and increased to 19 million barrels in December. New lines and extensions increased the movement northward from Texas and Oklahoma, the direction of flow in the lines crossing the Appalachians was reversed from west to east, and the capacity of the Plantation line was increased and new connections built to Baton Rouge, La., and Richmond, Va. The new 20-inch products line from the Gulf to the East coast was not completed until March 1944. This line will increase materially the shipments of gasoline and heating oils in 1944.

Although gasoline continues to be the major product moved, there has been a substantial increase in the shipment of other refined products by pipe line. A rough estimate for 1943 indicates that approximately 9 million barrels of kerosine and 19 million barrels of distillate fuel oil were so delivered.

Shipments of motor fuel by pipe lines in the United States in 1943, by months

[Thousands of barrels

	1943													1942 total
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
Motor fuel turned into lines	11,026	11,197	12,849	16,997	18,937	18,738	18,656	19,278	19,986	20,534	18,776	19,538	206,512	126,232
Motor fuel delivered from lines	9,909	10,500	12,245	17,343	19,076	18,773	18,752	19,172	19,310	20,747	18,822	19,029	203,678	125,341
Shortage	72	108	39	72	105	111	51	113	79	94	109	----------	953	677
Stocks in lines and working tanks, end of month	7,617	8,206	8,771	8,353	8,109	7,963	7,816	7,809	8,406	8,099	7,944	8,453	8,453	6,572

Rationing.—Rationing regulations by the Office of Price Administration had an important influence on motor-fuel demand. The various types of users entitled to gasoline rations include passenger-car, motorcycle, and commercial-car operators, nonhighway users, and military forces. Passenger-car rations were of three types, indicated by A, B, and C coupons. All passenger cars except those in commercial fleets were entitled to A coupons, and B and C coupons were given for supplemental driving required in connection with individual occupation or war needs.

The most important ration regulations were:

November 22, 1942.—Value of A coupons cut from 4 to 3 gallons in the Eastern Shortage Area (17 Eastern States and the District of Columbia), except West Virginia.

December 1, 1942.—Inclusion of the remainder of the States, in addition to the Gasoline Shortage Area, in the rationing program.

December 1–2, 1942.—Nation-wide registration of dealers and intermediate distributors.

December 8, 1942.—First quota set by the Petroleum Administration for War for the Eastern Shortage Area.

December 21, 1942.—Value of A, B, and C coupons in West Virginia cut from 4 gallons to 3.

January 7, 1943.—Pleasure driving prohibited in the Eastern Shortage Area.

February 10, 1943.—West Virginia removed from shortage area, although still left in P. A. W. District I.

March 3, 1943.—Pleasure-driving ban relaxed.

March 22, 1943.—Value of A rations cut in the shortage area by extending the valid period of A coupons to 4 months, which in effect reduced the ration from 2 gallons per week to 1½.

May 20, 1943.—Ban on pleasure driving reimposed in the critical part (north of the Carolinas) of the shortage area.

May 25, 1943.—Value of T or commercial rations cut 40 percent in the critical area by extending the valid period to July 25 instead of June 30.

June 2, 1943.—Value of B and C coupons in the critical area cut from 3 to 2½ gallons.

July 15, 1943.—Use of rations authorized for vacation travel.

August 13, 1943.—Petroleum Administration for War set the first Midwest quota covering September 1943.

August 16, 1943.—Value of A, B, and C coupons in the Midwest cut from 4 to 3 gallons.

September 1, 1943.—Ban on pleasure driving in the critical part of the shortage area removed.

October 1, 1943.—Value of A rations increased to 2 gallons weekly in the Eastern Shortage Area by shortening the valid periods of currently outstanding coupons. Those previously intended to last until November 21 were changed to expire on November 8, and those valid on November 9 were assigned a valid period of 3 months instead of 4.

October 1, 1943.—Value of B and C coupons cut as follows: In the critical part of the shortage area from 2½ to 2 gallons; in the remainder of the shortage area and in the Midwest from 3 to 2 gallons.

October 11, 1943.—Petroleum Administration for War set the first quota for the Far West covering the 4th quarter of 1943.

October 12, 1943.—Value of A, B, and C coupons in the Far West cut from 4 to 3 gallons.

December 1, 1943.—New B and C ration coupons (B-2 and C-2) issued for 5 gallons each.

KEROSINE AND RANGE OIL

The domestic demand for kerosine declined slightly in 1943, as transportation difficulties and rationing in the principal consuming areas continued to be restricting factors, as they were in 1942. An increase in kerosine production in 1943 was due entirely to a corresponding gain in crude runs to stills, as the percentage yield for both 1942 and 1943 remained at the same level. Exports of kerosine under pressure of Lend-Lease needs nearly doubled in volume in 1943 compared with 1942; but imports, never an important source of supply, declined by 10 percent. Kerosine stocks continued to shrink in 1943 but to a less-pronounced degree than in 1942.

The production of kerosine increased from 67,474,000 barrels in 1942 to 72,270,000 in 1943—a gain of 7 percent. The larger output of kerosine must be attributed solely to higher runs of crude (7 percent over 1942) in 1943, as the percentage yields were the same for both years. The kerosine yield might have been even higher had not refiners endeavored to obtain maximum quantities of heavy fuel oils.

Comparative analyses of statistics for kerosine in the United States, 1942-43, by months and districts

Month and district	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]
By months:								
January	6,634	5,602	5.6	5.0	9,749	8,096	11,007	7,222
February	6,133	5,852	5.8	5.7	7,741	6,954	9,324	5,942
March	6,035	6,326	5.5	5.6	7,230	7,043	7,900	4,868
April	5,529	6,299	5.3	5.6	5,516	5,355	7,806	5,326
May	5,302	6,511	4.9	5.7	4,593	5,070	8,433	6,486
June	4,929	6,060	4.7	5.2	3,661	4,184	9,497	8,237
July	5,134	5,769	4.6	4.8	3,320	4,134	10,933	9,195
August	5,340	5,394	4.7	4.3	4,036	3,735	12,176	10,286
September	5,421	5,817	4.8	4.6	5,022	4,383	12,363	10,910
October	5,907	5,977	5.1	4.6	5,381	5,514	12,645	11,299
November	5,759	6,138	5.1	4.9	5,695	6,667	12,630	10,487
December	5,351	6,525	4.7	5.0	7,823	7,596	10,064	9,359
Total United States	67,474	72,270	5.1	5.1	69,767	68,731	10,064	9,359
By districts:								
East Coast	7,929	7,561	4.9	3.9	(2)	(2)	2,853	3,062
Appalachian	3,640	3,697	6.3	6.7			337	308
Indiana, Illinois, Kentucky, etc.	15,802	14,370	6.0	5.4			1,554	2,314
Oklahoma, Kansas, and Missouri	8,984	8,470	6.9	6.8			576	656
Texas Inland	3,015	3,310	4.4	4.5			178	137
Texas Gulf Coast	17,364	22,060	5.7	6.6			2,456	1,365
Louisiana Gulf Coast	5,219	6,303	9.7	11.0			1,290	577
Arkansas and Louisiana Inland	2,460	2,304	8.6	8.5			214	213
Rocky Mountain	698	794	2.0	2.3			81	69
California	2,363	3,401	1.0	1.3			525	658
Total United States	67,474	72,270	5.1	5.1	69,767	68,731	10,064	9,359

[1] Subject to revision.

[2] Figures not available.

In the Texas Gulf Coast district, where more kerosine is made than in any other area, production increased by 27 percent in 1943 owing both to added crude runs and to a higher percentage yield. The Indiana-Illinois refinery district is the second most important source of kerosine; however, in that area the output declined by 9 percent in 1943 because of a lower percentage yield. Kerosine production dropped in the Oklahoma-Kansas and East Coast refinery districts in 1943, both important sources of this petroleum product. Lower runs of crude resulted in less kerosine for the Oklahoma-Kansas district in 1943, whereas in the East Coast a smaller percentage yield was the reason for the lower output. In other districts, such as the Appalachian, Texas Inland, Louisiana Gulf Coast, Rocky Mountain, and California, the production of kerosine increased in 1943, but a decline was reported for the Arkansas-Louisiana Inland area.

The indicated domestic demand for kerosine declined slightly from 69,767,000 barrels in 1942 to 68,731,000 in 1943, as rationing in principal consuming areas, inadequate transportation facilities, and a lower production in the East Coast (where about 65 percent of the kerosine market is located) were factors that prevented sufficient deliveries to satisfy normal requirements. The indicated demand for kerosine—as for other petroleum products—is calculated from stock fluctuations, production, imports, and exports. As data showing imports and exports for areas corresponding to refinery districts are not available, it is impossible to present a break-down of the indicated demand.

Exports of kerosine, which showed some shrinkage in 1942 due largely to tanker sinkings, developed a substantial increase in 1943 to 4,619,000 barrels, a gain of 79 percent over the 1942 total. The United Kingdom and its Dependencies continued to receive most of the kerosine exports in 1943, as they did in 1942. Kerosine shipped to Canada totaled 268,000 barrels in 1943 compared with 236,000 in 1942, and the quantity credited to the United Kingdom more than doubled, increasing from 1,671,000 barrels in 1942 to 3,782,000 in 1943.

Kerosine imports, never an important factor in the domestic supply, declined slightly from 418,000 barrels in 1942 to 375,000 in 1943.

Stocks of kerosine continued to decline in 1943, the year-end total of 9,359,000 barrels being 7 percent below the 1942 final inventory of 10,064,000 barrels. Information regarding stocks of kerosine held at bulk terminals did not become available until 1942. The break-down for kerosine storage for 1942 and 1943 was as follows: Held at refineries, 1942, 7,537,000 barrels, and 1943, 5,472,000; reported at bulk terminals, 1942, 2,527,000 barrels, and 1943, 3,887,000 barrels. Furthermore, total kerosine reported in storage represented 61 days in 1941, dropping to 40 days' supply in 1942 and to only 38 days' supply in 1943 at the respective rates of demand for the several years.

The net change in kerosine stocks for the several refinery districts in 1943 differed somewhat from those indicated for 1942. In 1942 transportation difficulties resulting from a forced change-over from water to land routes for kerosine as well as for other petroleum products caused a drastic drop in kerosine stocks on the East Coast and a decline to a smaller degree in the Indiana-Illinois refinery district, both areas of high kerosine consumption, and a rise in inventory in the Louisiana Gulf, as the product of refineries there could not be moved by the usual tanker route. In 1943 the land transportation of petroleum products (by tank car) had become better organized, with the result that a small but desirable build-up of kerosine stocks on the East coast was accomplished—the inventory rising from 2,853,000 barrels in 1942 to 3,062,000 at the end of 1943—and storage in the Indiana-Illinois refinery district also increased from 1,554,000 barrels in 1942 to 2,314,000 in 1943. Kerosine stocks in the Texas Gulf and Louisiana Gulf, important producing areas, declined in 1943, marking a more normal movement to East Coast and export markets. There was a nominal increase in kerosine stocks in the Oklahoma-Kansas refinery district (656,000 barrels in 1943 compared with 576,000 in 1942) although production declined in that area in 1943. The stock gain there could be attributed in part to a movement inland of Texas kerosine. A continued expansion of kerosine production in California in 1943, along with a curtailed export market, resulted in a 25-percent gain (525,000 barrels in 1942 and 658,000 in 1943) in quantities held in storage at the year end.

Sales of kerosine in the United States, 1941–42, by regions, States, and uses [1]

[Thousands of barrels]

Region and State	Sold as range oil		Tractor fuel		All other uses		Total	
	1941	1942	1941	1942	1941	1942	1941	1942
Pacific Coast:								
California	98	91	19	20	1, 188	1, 376	1, 305	1, 487
Oregon	10	15	10	8	116	135	136	158
Washington	14	22	--------	1	157	206	171	229
Arizona	12	16	5	28	133	185	150	229
Nevada	--------	2	--------	--------	26	44	26	46
Rocky Mountain:								
Idaho	2	1	11	9	19	23	32	33
Montana	39	33	45	50	69	61	153	144
Wyoming	8	10	15	15	18	15	41	40
Utah	5	6	4	6	16	14	25	26
Colorado	28	32	54	55	37	57	119	144
New Mexico	15	20	53	45	95	86	163	151
North Central:								
North Dakota	65	71	129	158	56	55	250	284
South Dakota	84	94	115	141	63	76	262	311
Minnesota	307	335	193	191	516	503	1, 016	1, 029
Nebraska	158	154	186	132	160	170	504	456
Iowa	217	210	194	152	645	663	1, 056	1, 025
Wisconsin	221	240	149	105	508	518	878	863
Illinois	1, 216	1, 455	258	262	1, 551	1, 691	3, 025	3, 408
Indiana	200	198	197	183	1, 183	1, 281	1, 580	1, 662
Michigan	282	283	95	115	801	848	1, 178	1, 246
Ohio	312	354	237	221	741	728	1, 290	1, 303
Kentucky	79	70	59	79	533	585	671	734
Tennessee	102	97	78	99	483	497	663	693
South Central:								
Missouri	423	451	166	170	610	669	1, 199	1, 290
Kansas	163	136	158	297	226	231	547	664
Texas	411	552	516	766	1, 740	1, 949	2, 667	3, 267
Oklahoma	146	135	268	266	524	546	938	947
Arkansas	136	118	190	194	460	599	786	911
Louisiana	108	98	162	193	730	770	1, 000	1, 061
Mississippi	52	59	130	110	346	366	528	535
Alabama	66	76	44	97	405	406	515	579
New England:								
Maine	1, 697	1, 582	4	11	36	52	1, 737	1, 645
New Hampshire	906	884	2	8	34	36	942	928
Vermont	638	593	1	2	88	71	727	666
Massachusetts	12, 931	11, 467	--------	1	453	416	13, 384	11, 884
Rhode Island	2, 434	2, 208	--------	2	93	81	2, 527	2, 291
Connecticut	3, 852	3, 687	--------	--------	126	106	3, 978	3, 793

See footnotes at end of table.

Sales of kerosine in the United States, 1941–42, by regions, States, and uses[1]*—Con.*

[Thousands of barrels]

Region and State	Sold as range oil		Tractor fuel		All other uses		Total	
	1941	1942	1941	1942	1941	1942	1941	1942
Middle Atlantic:								
New York	7,261	6,917	117	110	1,427	1,240	8,805	8,267
New Jersey	3,437	3,323	22	116	1,170	1,078	4,629	4,517
Pennsylvania	919	895	162	192	1,450	1,429	2,531	2,516
Delaware	95	84	3	3	68	61	166	148
Maryland	490	651	9	8	624	515	1,123	1,174
District of Columbia	85	104	9	5	82	72	176	181
South Atlantic:								
Virginia	173	191	11	17	687	698	871	906
West Virginia	53	59	13	14	168	150	234	223
North Carolina	665	775	76	72	710	719	1,451	1,566
South Carolina	170	191	31	45	429	422	630	658
Georgia	277	265	105	181	549	559	931	1,005
Florida	599	635	162	182	519	550	1,280	1,367
Total United States	41,661	39,945	4,467	5,137	22,868	23,608	68,996	68,690

[1] Figures for 1943 by States not yet available.

The Bureau makes an annual survey of kerosine distribution by States and principal uses. The distribution for 1943 is not available at this time; however, in 1942 kerosine sales of 68,690,000 barrels varied little from the 1941 total of 68,996,000 barrels. Rationing in important consuming areas and transportation difficulties caused some shifts in principal uses. The demand for range oil declined from 41,661,000 barrels in 1941 to 39,945,000 in 1942 or from 60 percent of kerosine deliveries in 1941 to 58 percent in 1942, as adequate supplies of kerosine could not be shipped from the Gulf Coast to the North Atlantic area, an important range-oil market. Supplies tended to "back up" in the south central and adjacent territory, with the result that kerosine sales for tractor fuel and other uses expanded. Kerosine delivered for tractor fuel increased by 15 percent from 4,467,000 barrels in 1941 to 5,137,000 in 1942, but all other uses (23,608,000 barrels) were about 3 percent over the 1941 total of 22,868,000 barrels. As No. 1 fuel oil differs so little from lower grades of kerosine it is sometimes sold as range oil. This No. 1 fuel oil (4,978,000 barrels in 1942 compared with 4,449,000 in 1941) must be added to the kerosine sold as range oil to determine total range-oil requirements—44,923,000 barrels in 1942, a quantity 3 percent below the 1941 total of 46,110,000 barrels.

There were few changes in representative kerosine prices in 1943. The average monthly quotation of 4.44 cents a gallon for 41°–43° gravity water-white kerosine at refineries in Oklahoma dating from March 4, 1942, remained unchanged until September 9, 1943, when the price dropped to 4.38 cents—lowering the average for the year to 4.42 cents compared with 4.46 cents a gallon average in 1942. The tank-wagon price of kerosine at Chicago of 10.6 cents a gallon, effective December 31, 1942, held unchanged throughout 1943.

Sales of range oil in the United States, 1940–42, by States [1]

[Thousands of barrels]

State	1940	1941	1942	
			Total	Percent of total
Massachusetts	13,419	13,187	11,682	26.0
New York	7,613	7,711	7,128	15.9
Connecticut	3,921	3,963	3,771	8.4
New Jersey	3,556	3,626	3,449	7.7
Illinois	1,733	2,185	2,789	6.2
Rhode Island	2,619	2,495	2,292	5.1
Maine	1,704	1,827	1,627	3.6
Michigan	620	712	934	2.1
Pennsylvania	920	949	919	2.0
New Hampshire	898	907	914	2.0
North Carolina	577	667	785	1.7
Wisconsin	516	616	781	1.7
Iowa	335	456	674	1.5
Minnesota	555	670	663	1.5
Maryland	531	518	662	1.5
Florida	542	628	654	1.5
Vermont	560	638	593	1.3
Texas	325	416	558	1.2
Missouri	485	477	553	1.2
Ohio	398	457	472	1.1
Indiana	272	355	439	1.0
Other States	2,593	2,650	2,584	5.8
Total United States	44,692	46,110	44,923	100.0

[1] Figures for 1943 by States not yet available.

FUEL OIL

The demand for fuel oil expanded to a record volume in 1943, as the United States completed its change to a war economy. New production, imports, and transfers from crude petroleum did not satisfy market requirements, so a critical draft on stocks was necessary for the second consecutive year. The domestic demand for fuel oil increased by 14 percent from 591,358,000 barrels in 1942 to 673,428,000 in 1943, and this gain was realized in spite of rationing in some important consuming areas and the difficulties of free movement of supplies. The domestic market for both light and heavy fuel oils expanded substantially in 1943. Requirements for distillate grades increased from 185,661,000 barrels in 1942 to 208,935,000 in 1943—a gain of 13 percent—and deliveries of residual fuel oils of 464,493,000 barrels in 1943 were 14 percent above the 1942 total of 405,697,000 barrels.

The domestic demand for both light and heavy fuel oils was lower in the first quarter of 1943 compared with the same period of 1942, although the weather was colder in the 1943 quarter and industrial activities were at a higher level due to war needs. Requirements for distillate fuel oils declined by 6 percent from 65,314,000 barrels in the opening quarter of 1942 to 61,171,000 in the corresponding months of 1943, and the market for heavy grades dropped 3 percent from 108,518,000 barrels in the January–March period of 1942 to 105,103,000 in the first quarter of 1943. The shrinkage in fuel-oil requirements during the first 3 months of 1943, when reviewed from another angle, shows that the quarter's total represented only 29 percent of the year's demand for distillate grades compared with a 35-percent proportion in the first quarter of 1942; and the heavy grades marketed in the opening quarter of 1943 were 23 percent of the year's requirements compared with a 27-percent share falling within the first 3 months of 1942. Rationing of heating oils, conversions to other fuels, restrictions on oil-burner installations, and transportation difficulties were all factors that reacted negatively on the fuel-oil market during the first quarter of 1943.

Salient statistics of fuel oil in the United States, 1942–43

[Thousands of barrels]

	1942			1943 [1]		
	Distillate fuel oil	Residual fuel oil	Total	Distillate fuel oil	Residual fuel oil	Total
Stocks at beginning of year:						
Refinery	36,322	68,727	105,049	32,659	49,961	82,620
Bulk terminal	13,008	14,232	27,240	12,281	11,822	24,103
Production	196,714	358,901	555,615	211,516	417,306	628,822
Transfers from crude oil to fuel oil:						
California	12	14,658	14,670	19	18,861	18,880
East of California	2,484	4,625	7,109	3,051	5,226	8,277
Imports	3,636	18,432	22,068	15,999	26,567	42,566
Exports	21,575	12,095	33,670	24,862	16,766	41,628
Stocks at end of year:						
Refinery	32,659	49,961	82,620	27,816	38,855	66,671
Bulk terminal	12,281	11,822	24,103	13,912	9,629	23,541
Indicated domestic demand:						
Class I railroads, purchases [2]	(4)	(4)	104,072	(4)	(4)	121,070
Public-utility power plants [3]	(4)	(4)	15,281	(4)	(4)	18,085
All other demands	(4)	(4)	472,005	(4)	(4)	534,273
	185,661	405,697	591,358	208,935	464,493	673,428

[1] Subject to revision.
[2] Interstate Commerce Commission; total includes Diesel fuel.
[3] Federal Power Commission.
[4] Figures not available.

The decline in fuel-oil demand during the opening months of 1943 was only temporary, as the trend turned sharply upward in the second quarter when deliveries of distillate grades increased by 27 percent (46,534,000 barrels for the second quarter of 1943 compared with 36,595,000 in the same period of 1942), and requirements for residual fuel oil (112,189,000 barrels) were 15 percent above the total of 97,701,000 reported in the second quarter of 1942. Sales of fuel oil increased in volume during the July–September period of 1943, when light fuel deliveries (44,935,000 barrels in the third quarter of 1943 compared with 31,975,000 in the corresponding portion of 1942) were 41 percent above the 1942 total and the market for heavy grades increased by 29 percent (118,291,000 barrels for the third quarter of 1943 compared with 91,777,000 in 1942). This pyramiding of fuel-oil deliveries falling within the third quarter of 1943 was due to several factors, namely, improved transportation facilities, stocking of supplies by dealers in anticipation of the approaching heating-oil season, and peak industrial activities in connection with the war. The percentage rate of increase in the fuel-oil demand slackened somewhat in the fourth quarter of 1943, especially for distillate grades, as consumers of heating oils were fairly well stocked from the previous quarter; furthermore December 1943 was warmer than the same month of 1942. Deliveries of light fuel oils in the final quarter of 1943 (56,295,000 barrels) were 9 percent above the demand of 51,777,000 barrels in the same period of 1942, but requirements for heavy grades (128,910,000 barrels) were 20 percent over the comparative total of 107,701,000 barrels in 1942.

There is very little available information at present regarding the change in principal demands for fuel oil in 1943 compared with 1942. However, it is known from monthly data compiled by Government agencies that the quantity of fuel oil used by the transportation industries—railroads and vessels—increased sharply in 1943. The demand for fuel oil by the Navy also expanded outstandingly because of greatly increased war activities and the addition of numerous new units to the fleet. It is believed that the remaining major demands for fuel oil in 1943 were only moderately above the 1942 levels.

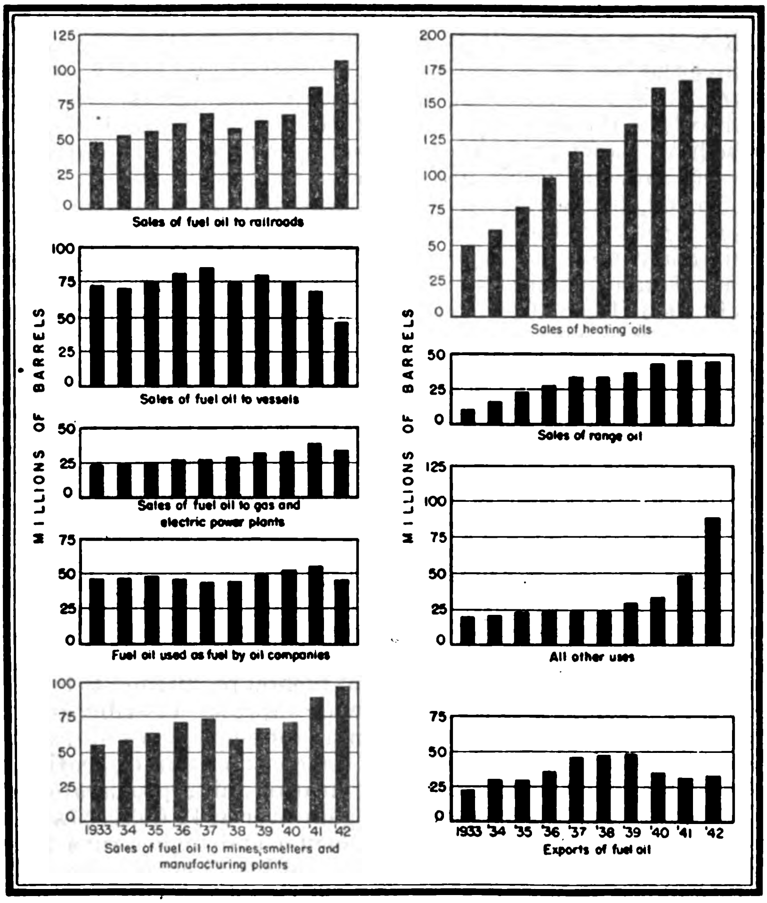

FIGURE 10.—Sales of fuel oil and range oil in the United States, 1933–42, by uses.

Class I railroads purchased 121,070,000 barrels of fuel oil in 1943, a 16-percent gain over the 1942 total of 104,072,000 barrels, according to monthly reports released by the Interstate Commerce Commission. The railroad demand for fuel oil in 1943 showed a lower percentage rate of expansion than that recorded in 1942 over 1941 (24 percent), a fact indicating that the railroad industry has probably reached peak requirements for fuel oil under prevailing war conditions.

The market for fuel-oil bunkers, at a very low level in 1942 due to sinkings by submarines, rebounded sharply in 1943, as indicated by monthly figures covering loadings on vessels engaged in foreign trade as compiled by the Division of Foreign Trade Statistics, Bureau of the Census. Vessels plying in foreign trade purchased 49,453,000 barrels of bunker fuel oil at American continental ports in 1943—a 95 percent gain over the 1942 total of 25,418,000 barrels. No records are available covering fuel-oil requirements of vessels in coastwise trade; however, it is believed that, with enemy submarines driven from coastal waters, the coastwise share of the fuel-oil bunker business will likewise have shown great improvement in 1943, so that total loadings for vessels both in foreign and coastwise trade will have expanded to about 75,000,000 barrels—a total comparable with normal requirements in recent pre-war years.

Preliminary monthly reports of the Federal Power Commission show an 18-percent increase in the use of fuel oil by electric power plants in 1943 (18,085,000 barrels in 1943 compared with 15,281,000 in 1942) in contrast with a 25-percent drop in 1942 compared with 1941 requirements. A gain in the use of fuel oil by the manufactured-gas industry in 1942 probably was repeated in 1943, so that purchases of fuel oil by the public-utility gas and electric-power plants will total about 38,000,000 barrels in 1943 compared with 33,805,000 in 1942—a 12-percent gain.

It is not believed that fuel oil going to smelters, mines, and manufacturing establishments exceeded 98,000,000 barrels in 1943 (1 percent over 1942 purchases), as forced conversion to other fuels approached peak levels and limited supplies of fuel oil in the East Coast area, where over half of the demand is located, were factors that prevented any great rise in consumption. More than 60 percent of distillate fuel oil and over one-quarter of the residual fuel oil marketed are sold for space heating; and, as total fuel-oil requirements increased 14 percent in 1943, it is evident that with improved distribution and a more generous allowance under rationing for some types of dwellings, there was at least a moderate rise in the consumption of heating oils. It is estimated that the demand for heating oil approximated 179,000,000 barrels in 1943—a 6-percent gain over 1942 deliveries.

Increased production of crude petroleum and higher runs to stills indicate some increase in the use of fuel oil by oil companies in 1943. This demand is estimated at 47,250,000 barrels for 1943—a gain of about 3 percent. Fuel oil sold for all other uses, including the Navy, probably increased by 23 percent in 1943—to about 108,000,000 barrels.

The principal uses of fuel oil are shown graphically for 1933 through 1942 in figure 10. The length of the respective columns, indicating the demand by principal uses for each year, is based upon totals reported in the annual fuel-oil survey of the Bureau. Distillate fuel oil, residual fuel oil, and kerosine sold as range oil are included.

Sales of fuel oil [1] *and of range oil in the United States, 1938–42, by uses* [2]

[Thousands of barrels]

Use	1938	1939	1940	1941	1942
Fuel oil:					
Railroads	57, 829	63, 235	68, 098	85, 510	106, 484
Ships' bunkers (including tankers)	74, 266	79, 254	74, 803	67, 635	46, 717
Gas and electric power plants	27, 567	32, 039	32, 795	38, 774	33, 806
Smelters, mines, and manufacturing industries	60, 038	67, 043	73, 940	88, 387	97, 132
Heating oils	118, 323	136, 232	160, 379	167, 514	168, 989
Fuel oil (No. 1) sold as range oil	2, 902	3, 220	3, 977	4, 449	4, 978
Oil company fuel	43, 517	49, 045	51, 928	55, 297	45, 935
All other uses	23, 408	26, 875	32, 838	46, 763	88, 106
Total United States	407, 850	456, 943	498, 758	554, 329	592, 146
Exports and shipments to noncontiguous Territories	47, 561	49, 505	35, 249	31, 039	33, 670
Total	455, 411	506, 448	534, 007	585, 368	625, 816
Range oil	33, 707	37, 061	44, 692	46, 110	44, 923

[1] Includes distillate fuel oil, residual fuel oil, and some crude oil burned as fuel.
[2] Figures for 1943 not yet available.

Sales of distillate fuel oil [1] *in the United States, 1938–42, by uses* [2]

[Thousands of barrels]

Use	1938	1939	1940	1941	1942
Railroads	1, 720	2, 258	3, 194	4, 945	6, 488
Ships' bunkers (including tankers)	13, 088	14, 108	13, 249	10, 957	8, 900
Gas and electric power plants	3, 685	4, 131	4, 561	5, 152	5, 704
Smelters, mines, and manufacturing industries	5, 224	6, 192	7, 330	10, 363	12, 617
Heating oils	82, 388	97, 131	115, 533	120, 908	121, 506
Fuel oil (No. 1) sold as range oil	2, 902	3, 220	3, 977	4, 449	4, 978
Oil company fuel	939	804	1, 064	1, 116	1, 064
All other uses	7, 495	10, 726	11, 744	15, 449	25, 556
Total United States	117, 441	138, 570	160, 652	173, 339	186, 813
Exports and shipments to noncontiguous Territories	29, 641	32, 020	19, 140	16, 925	21, 575
Total	147, 082	170, 590	179, 792	190, 264	208, 388

[1] Includes Diesel fuel.
[2] Figures for 1943 not yet available.

Sales of residual fued oil [1] *in the United States, 1938–42, by uses* [2]

[Thousands of barrels]

Use	1938	1939	1940	1941	1942
Railroads	56, 109	60, 977	64, 904	80, 565	99, 996
Ships' bunkers (including tankers)	61, 178	65, 146	61, 554	56, 678	37, 817
Gas and electric power plants	23, 882	27, 908	28, 234	33, 622	28, 101
Smelters, mines, and manufacturing industries	54, 814	60, 851	66, 610	78, 024	84, 515
Heating oils	35, 935	39, 101	44, 846	46, 606	47, 483
Oil company fuel	42, 578	48, 241	50, 864	54, 181	44, 871
All other uses	15, 913	16, 149	21, 094	31, 314	62, 550
Total United States	290, 409	318, 373	338, 106	380, 990	405, 333
Exports and shipments to noncontiguous Territories	17, 920	17, 485	16, 109	14, 114	12, 095
Total	308, 329	335, 858	354, 215	395, 104	417, 428

[1] Includes Navy grade and crude oil burned as fuel.
[2] Figures for 1943 not yet available.

Important quantities of fuel oil shipped to allied countries under Lend-Lease agreements boosted the export demand from 33,670,000 barrels in 1942 to 41,628,000 in 1943—a gain of 24 percent. Distillate grades of fuel oil continued to represent the bulk of fuel-oil exports in 1943, as they have for a number of years, and totaled 24,862,000 barrels in 1943—a gain of 15 percent (28 percent increase in 1942 over 1941) compared with 21,575,000 reported for 1942. The export total for heavy fuel oil was 16,766,000 barrels in 1943—a 39-percent gain over the 1942 overseas demand of 12,095,000 barrels. The increase for residual grades in 1943, reflecting an improvement in tanker facilities and expanded war demands, is in contrast to a 14-percent decline in 1942.

The United Kingdom and Dominions of the British Commonwealth received the bulk of American exports of fuel oil for both 1942 and 1943. Light fuel oils credited to the United Kingdom increased from 15,117,000 barrels in 1942 to 16,797,000 in 1943. Larger shipments of American distillate fuel oil to Oceania (mostly to Australia and New Zealand) of 4,677,000 barrels in 1943 compared with 1,918,000 in 1942 resulted partly from the cutting off of normal supplies from the Netherlands East Indies to that area. Exports of light fuel oil to Canada dropped from 493,000 barrels in 1942 to 423,000 in 1943. A sizable item covering distillate fuel oil shipped to U. S. S. R. appears for the first time—264,000 barrels in 1943 compared with 71,000 in 1942.

Over three-fifths of all exports of residual fuel oil went to the United Kingdom in 1943 compared with about one-quarter of the 1942 total. The quantity credited to the United Kingdom increased from 3,179,000 barrels in 1942 to 10,683,000 in 1943, an expanded total made possible by a greater tanker fleet and the fading submarine menace. Relatively less important quantities of heavy fuel oil were shipped to Canada (907,000 barrels in 1943 and 1,271,000 in 1942), Mexico (584,000 barrels in 1943 and 433,000 in 1942), the West Indies (684,000 barrels in 1943 and 1,141,000 in 1942), and Oceania (456,000 barrels in 1943 and 509,000 in 1942).

The production of fuel oil increased 13 percent in 1943 compared with 1942 because of higher runs of crude to stills (7 percent over 1942) and a greater percentage yield. The output of fuel oil in 1943 (628,822,000 barrels) represents a yield of 44 percent and compares with a production of 555,615,000 barrels in 1942—a yield of 41.6 percent. When light and heavy fuel oils are reviewed separately, it is found that the production of distillate grades increased 8 percent—from 196,714,000 barrels in 1942 to 211,516,000 in 1943. As the yield for distillate fuel oil for 1943 (14.8 percent) was practically unchanged from the 1942 level (14.7 percent), increased runs of crude must be considered the sole factor resulting in the higher output. The larger share of the expanded production of fuel oils must be credited to the heavier grades, the yield of which increased 16 percent (from 358,901,000 barrels in 1942 to 417,306,000 in 1943)—a gain attributable not only to the greater volume of crude runs but to an improved yield of 29.2 percent in 1943 compared with 26.9 percent in 1942. The expanded output of heavy fuel oil was possible and most opportune at the time of a rising demand, as the 1943 market for motor fuel was below the 1942 level for the first three quarters of the year owing to inadequate transportation and to rationing. In other words, there was no need to keep down the yield of residual fuel oils to make more profitable motor fuels, the usual practice under normal conditions.

Sales of fuel oil[1] *in the United States, 1938–42, by regions and States*[2]

[Thousands of barrels]

Region and State	1938	1939	1940	1941	1942
Pacific Coast:					
Washington	9,241	9,193	9,688	12,199	16,029
Oregon	9,308	8,752	11,089	12,562	15,577
California	59,316	69,790	71,516	77,201	99,839
Arizona	2,838	2,220	3,693	4,431	4,819
Nevada	2,690	3,109	3,418	4,286	6,057
Rocky Mountain:					
Idaho	420	483	565	750	1,080
Montana	1,451	1,947	2,077	3,220	3,894
Wyoming	1,654	1,853	2,012	2,262	2,613
Utah	471	485	603	692	995
Colorado	636	880	1,097	1,474	1,794
New Mexico	502	557	630	701	779
North Central:					
North Dakota	442	594	647	677	703
South Dakota	777	891	891	909	904
Minnesota	4,974	5,909	6,939	7,309	7,737
Nebraska	1,982	2,483	2,721	2,766	2,781
Iowa	2,325	2,969	3,449	3,998	4,724
Wisconsin	4,748	5,793	6,885	7,344	7,497
Illinois	19,930	22,561	26,182	28,943	30,724
Indiana	7,824	8,977	9,965	12,782	12,178
Michigan	8,228	10,119	11,967	13,584	14,917
Ohio	7,105	8,161	9,084	10,970	12,873
Kentucky	840	1,110	1,355	1,697	2,154
Tennessee	557	695	1,045	1,263	1,549
South Central:					
Missouri	8,502	9,339	10,404	10,948	11,219
Kansas	6,687	7,605	8,162	9,277	9,046
Texas	37,672	42,012	43,222	51,634	63,449
Oklahoma	8,269	8,112	8,544	9,303	9,332
Arkansas	2,056	2,156	2,562	3,136	3,511
Louisiana	10,871	11,318	11,810	17,151	13,864
Mississippi	529	631	619	999	812
Alabama	2,113	2,127	1,976	2,780	3,313
New England:					
Maine	2,150	2,645	3,040	3,892	3,331
New Hampshire	1,431	1,812	2,153	2,565	2,043
Vermont	539	675	803	901	813
Massachusetts	21,362	24,392	26,857	29,996	25,703
Rhode Island	6,839	7,893	8,839	9,594	7,835
Connecticut	7,482	9,064	10,675	11,358	10,355
Middle Atlantic:					
New York	43,389	48,154	54,520	56,780	54,128
New Jersey	42,862	48,087	49,578	47,904	47,972
Pennsylvania	26,213	27,285	29,269	31,479	31,249
Delaware	1,400	1,596	1,717	1,803	1,814
Maryland	9,003	10,218	12,286	13,436	13,321
District of Columbia	2,137	2,541	2,986	3,459	3,317
South Atlantic:					
Virginia	4,824	4,539	4,794	4,462	4,388
West Virginia	912	1,046	1,128	1,261	1,283
North Carolina	699	930	1,112	1,384	1,641
South Carolina	757	1,109	1,253	1,404	1,652
Georgia	2,022	2,288	2,418	2,958	2,851
Florida	8,871	9,838	10,513	12,445	12,187
Total United States	407,850	456,943	498,758	554,329	592,146

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[1] Includes distillate fuel oil, residual fuel oil, and some crude oil burned as fuel.
[2] Figures for 1943 not yet available.

The higher production of distillate fuel oil in 1943 must be credited almost entirely to four refinery districts—the East Coast, Texas Inland, Texas Gulf Coast, and California—as in the other areas there was a decline or only a nominal gain in output of light fuel oils. The urgent need for a greater supply of light heating oils in the important East Coast consuming area in 1943 was partly met by a 22-percent expansion in production. The improved light-fuel-oil output in the East Coast district was associated mostly with a 21-percent increase in crude runs, as the yield for distillates remained fairly constant for 1942 and 1943. A 7-percent increase in crude runs to stills as well as a higher yield (6.4 percent in 1943 compared with 5.4 percent in 1942) made possible a 28-percent gain in distillate production in the Texas Inland district. Refineries operating in the Texas Gulf Coast dropped their yield of distillates from 19.8 percent in 1942 to 19.3 percent in 1943; nevertheless, a 9-percent increase in crude runs resulted in a gain of 6 percent in production for the light grades of fuel oil. A greatly expanded demand for fuel oils in California was partly satisfied by an 18-percent gain in distillate production. The improvement in the light-fuel-oil output in California was due mostly to a 15-percent increase in crude runs and to a smaller degree to a higher percentage yield. The Appalachian, Oklahoma-Kansas, Arkansas and Louisiana Inland, and Rocky Mountain refinery districts produced less light fuel oil in 1943 than in 1942, and gains reported for the Indiana-Illinois and Louisiana Gulf areas were relatively unimportant.

Refiners responded to war needs in 1943 by producing more residual fuel oil in all districts, especially in the East Coast, Indiana-Illinois, Texan Inland, Texas Gulf, and California areas. A 23-percent increase in heavy-fuel-oil output was reported for the East Coast—a gain made possible largely by greatly expanded crude runs, as the yield of 28.8 percent for the area was little above the 1942 level. There was a 7-percent increase in heavy-fuel-oil production for the Indiana-Illinois refinery district due to a higher yield of 22.5 percent in 1943 compared with 21.0 percent in 1942. All of the respective percentage gains in residual-fuel-oil production in 1943—37 percent for the Texas Inland district, 16 percent for the Texas Gulf, and 22 percent for California—were realized both by the processing more crude petroleum and an upward adjustment in percentage yields at the expense of possible gasoline production. Percentage gains in heavy-fuel-oil output were reported for all other refinery districts, but the respective increments were less outstanding.

Crude petroleum (usually low in gasoline content), used in some producing areas in lieu of fuel oil, must be counted as additional supply in fuel-oil statistics. The term "transfers" is applied to crude oil burned direct as fuel, as it covers quantities transferred from the crude oil to the fuel-oil account on the oil companies' books. Crude petroleum may be transferred to the distillate or the residual-fuel-oil account, depending on its "gravity" and the purpose for which it is used. Transfers of distillate grade, consumed as fuel on pipe lines, were reported in areas east of California for a total of 3,051,000 barrels in 1943—a gain of 23 percent over the 1942 quantity of 2,484,000 barrels. A small amount—19,000 barrels—was similarly used in

California in 1943. More important volumes of crude petroleum burned in place of residual fuel oil on leases and by industrial plants were indicated for California and other areas. The California transfers of heavy crude totaled 18,861,000 barrels in 1943—a gain of 29 percent over the 1942 comparative item—and in areas east of California there was a gain of 13 percent—5,226,000 barrels in 1943 compared with 4,625,000 in 1942.

The building of many new tankers, the release of some vessels from military use, and the driving of enemy submarines from coastal waters were all favorable factors that made possible the receipt of 42,566,000 barrels of fuel-oil imports in 1943—a 93-percent gain over the greatly curtailed total of 22,068,000 in 1942. Imports of both distillate and residual grades showed important expansion in 1943. Receipts of distillate fuel oil increased from 3,636,000 barrels in 1942 to 15,999,000 in 1943—the latter quantity representing 7 percent of the total supply of light fuel oils from all sources in 1943 compared with a 2 percent share in 1942. Heavy fuel oils received from foreign countries totaled 26,567,000 barrels in 1943—an improvement of 44 percent over the 1942 quantity of 18,432,000 barrels. Imported residual fuel oil constituted 6 percent of the total supply for the domestic and export markets in 1943 compared with a 4-percent portion in 1942.

The usual sources of supply for fuel oils—production, imports, and transfers from crude oil—were not sufficient to meet total demand in 1943, so a heavy draft of stocks was necessary for a second consecutive year. Total fuel-oil stocks of 90,212,000 barrels at the end of 1943 were approximately 16,500,000 barrels below those held at the close of 1942. It should be added, however, that the liquidation of fuel-oil stocks in 1943 was somewhat below the shrinkage in inventory of approximately 25,600,000 barrels during the critical year 1942. Expressed in still another way, fuel oil taken from storage was used to satisfy about 2 percent of the total demand in 1943 compared with a 4-percent share in 1942. Fuel oil held at the close of 1943 represented a 41-day domestic supply at the December rate of consumption compared with a 55-day "backlog" at the end of 1942. Distillate-fuel-oil stocks at the end of 1943 were equivalent to a 59-day supply compared with about a 62-day quantity at the close of 1942. The residual-fuel-oil inventory was critically low at the end of 1943—a 33-day supply against a 50-day domestic reserve, as of December 31, 1942.

The decline in fuel-oil stocks in 1943 is found more in the residual grades than in the distillate fuel oils. Heavy fuel oils held in storage at the close of 1943 (48,484,000 barrels) were 13,300,000 below the 1942 final inventory, but the lighter fuel oils declined by only 3,200,000 barrels from 44,940,000 in 1942 to 41,728,000 in 1943. The 1943 liquidation of heavy fuel oils was somewhat below the 1942 draft of over 21,000,000 barrels, and about 1,200,000 barrels less light fuel oil were taken from storage in 1943 than in 1942.

Comparative analyses of statistics for distillate fuel oil in the United States, 1942–43, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers [1]				Imports		Exports		Domestic demand		Stocks	
					East of California		California									
	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]
By months:																
January	16,902	17,306	14.2	15.5	225	224	2	--------	403	181	1,131	1,442	24,930	22,195	40,801	39,014
February	15,194	16,240	14.4	15.9	178	213	--------	--------	369	432	1,070	1,570	21,761	19,031	33,711	35,298
March	16,214	17,288	14.7	15.4	186	229	1	--------	407	170	1,691	1,905	18,623	19,945	30,205	31,135
April	14,002	16,690	13.4	14.9	185	290	2	--------	92	612	1,880	2,295	13,814	15,758	28,792	30,674
May	13,436	16,075	12.6	14.0	200	247	--------	3	296	499	1,171	2,455	11,272	14,378	30,281	30,665
June	15,210	15,261	14.4	13.2	188	242	7	--------	215	5,016	1,891	2,319	11,509	16,398	32,501	32,467
July	16,149	16,073	14.5	13.3	206	265	--------	--------	30	2,202	3,466	3,493	7,691	13,190	37,729	34,324
August	17,052	18,210	14.9	14.3	213	253	--------	--------	152	3,548	1,602	2,737	10,626	16,667	42,918	36,931
September	18,062	18,523	15.9	14.7	217	261	--------	--------	98	978	1,820	1,934	13,658	15,078	45,817	39,681
October	18,858	20,549	16.2	15.9	227	279	--------	--------	422	953	2,497	1,772	13,126	14,833	49,701	44,857
November	17,562	19,370	15.6	15.3	215	269	--------	16	619	1,065	1,344	1,308	16,044	19,463	50,709	44,806
December	18,073	19,931	16.0	15.1	244	279	--------	--------	533	343	2,012	1,632	22,607	21,999	44,940	41,728
Total, United States	196,714	211,516	14.7	14.8	2,484	3,051	12	19	3,636	15,999	21,575	24,862	185,661	208,935	44,940	41,728
By districts:																
East Coast	31,132	38,077	19.3	19.6	--------	--------	--------	--------	(3)	(3)	(3)	(3)	(3)	(3)	8,415	12,293
Appalachian	6,769	6,460	11.8	11.8	--------	--------	--------	--------							860	1,074
Indiana, Illinois, Kentucky, etc	34,388	34,631	13.0	13.1	552	621	--------	--------							5,783	5,873
Oklahoma, Kansas, and Missouri	18,344	17,099	14.2	13.8	861	962	--------	--------							2,155	1,795
Texas Inland	3,664	4,701	5.4	6.4	658	770	--------	--------							331	375
Texas Gulf Coast	60,697	64,506	19.8	19.3	186	352	--------	--------							12,336	7,452
Louisiana Gulf Coast	9,428	9,477	17.6	16.6	98	124	--------	--------							1,671	1,306
Arkansas and Louisiana Inland	4,112	4,017	14.4	14.8	38	40	--------	--------							826	524
Rocky Mountain	3,782	3,667	11.0	10.4	91	182	--------	--------							378	362
California	24,398	28,881	10.6	10.9	--------	--------	12	19							12,185	10,674
Total, United States	196,714	211,516	14.7	14.8	2,484	3,051	12	19	3,636	15,999	21,575	24,862	185,661	208,935	44,940	41,728

[1] Figures represent crude oil used as fuel on pipe lines.
[2] Subject to revision.
[3] Figures not available.

Comparative analyses of statistics for residual fuel oil in the United States, 1942–43, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers [1]				Imports		Exports		Domestic demand		Stocks	
					East of California		California									
	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [2]	1942	1943 [3]	1942	1943 [2]
By months:																
January	29,405	32,544	24.7	29.2	589	351	1,041	1,699	3,356	537	1,672	1,248	37,292	34,858	78,386	60,808
February	27,254	30,799	25.7	30.2	450	344	1,060	1,364	3,297	1,488	517	1,076	34,544	34,070	75,386	59,657
March	28,095	32,700	25.4	29.2	304	384	1,309	1,530	2,724	252	1,038	1,068	36,682	36,175	70,098	57,280
April	29,440	34,095	28.0	30.5	361	422	1,465	1,415	1,483	1,795	862	1,669	34,327	35,957	67,658	57,381
May	30,971	33,732	29.0	29.3	366	395	1,638	1,428	858	3,460	1,366	1,876	31,737	36,763	68,388	57,757
June	28,352	33,510	26.9	28.9	336	429	1,274	1,205	678	3,355	1,050	908	31,637	39,469	66,341	55,879
July	30,096	36,624	27.0	30.3	360	433	1,079	1,135	746	3,007	626	2,290	31,061	37,681	66,935	57,107
August	30,446	37,418	26.7	29.5	339	503	1,025	1,686	495	4,259	1,101	2,082	30,526	42,034	67,613	56,857
September	30,402	36,610	26.8	29.0	354	494	1,617	1,759	456	1,566	988	733	30,190	38,576	69,264	57,977
October	31,239	34,663	26.8	26.9	427	478	1,068	1,839	1,882	2,653	881	1,528	34,126	41,130	68,873	54,952
November	31,311	36,649	27.9	29.0	391	508	1,116	2,037	1,247	2,204	740	1,032	35,534	42,272	66,664	53,046
December	31,890	37,962	28.1	28.8	348	485	966	1,764	1,210	1,991	1,254	1,256	38,041	45,508	61,783	48,484
Total United States	358,901	417,306	26.9	29.2	4,625	5,226	14,658	18,861	18,432	26,567	12,095	16,766	405,697	464,493	61,783	48,484
By districts:																
East Coast	45,653	56,004	28.3	28.8	...	...	...	...	(3)	(3)	(3)	(3)	(3)	(3)	3,613	6,341
Appalachian	9,498	10,274	16.5	18.7	...	...	...	...							579	324
Indiana, Illinois, Kentucky, etc	55,545	59,621	21.0	22.5	689	678	...	...							2,446	2,983
Oklahoma, Kansas, and Missouri	24,788	24,969	19.2	20.1	278	240	...	...							1,332	1,003
Texas Inland	16,586	22,742	24.3	31.2	602	759	...	...							761	746
Texas Gulf Coast	74,778	86,549	24.4	25.8	1,174	1,029	...	...							6,275	8,136
Louisiana Gulf Coast	11,772	12,768	22.0	22.3	897	1,161	...	...							1,714	1,355
Arkansas and Louisiana Inland	6,734	7,294	23.5	26.9	720	664	...	...							183	261
Rocky Mountain	9,292	10,229	27.0	29.1	265	695	...	...							649	727
California	104,255	126,856	45.3	48.1	...	...	14,658	18,861							44,231	26,608
Total United States	358,901	417,306	26.9	29.2	4,625	5,226	14,658	18,861	18,432	26,567	12,095	16,766	405,697	464,493	61,783	48,484

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[1] Represents quantities used on leases and for general industrial purposes.
[2] Subject to revision.
[3] Figures not available.

Fluctuations in fuel-oil stocks held in the several refinery districts in 1943 presented a somewhat different picture from the changes recorded in 1942, when normal water-borne movement of supplies to eastern consuming centers was shifted to land routes—tank cars and pipe lines. In 1942 distillate-fuel-oil stocks dropped by more than half in the East Coast, as lack of tankers prevented the usual flow of light grades from the most important producing center—the Texas Gulf Coast—to the eastern seaboard, with the result that supplies piled up in the Gulf area. Improvement in shipping facilities in 1943 allowed a desirable "build-up" in inventory of distillates on the East coast and a liquidation of supplies in the Gulf areas. In 1942 stocks of residual fuel oils dropped drastically by over 21,000,000 barrels because of a 6-percent higher domestic demand, a sharp drop in imports, and the transitional shift in transportation routes. Changed conditions in 1943 allowed some improvement in the residual-fuel-oil stock situation in the East coast area; however, a large shrinkage in the California inventory was repeated for a second year.

Stocks of light fuel oil on the East Coast increased by about 3,900,000 barrels in 1943, in contrast with a 9,600,000-barrel liquidation in 1942. The Appalachian, Indiana-Illinois, and Texas Inland districts reported minor gains in distillates held in storage at the end of 1943 over 1942. Inventories of light oils declined in all other refienry areas, losses being more pronounced in the Texas Gulf and California districts. More than half of the heavy fuel oil is held in California, and there a drop of approximately 9,000,000 barrels in storage supplies in 1942 was followed by a further serious decline of about 17,600,000 barrels in 1943. Put in another way, heavy fuel oil stored in California has shrunk by 50 percent in volume in a 2-year period—from 53,199,000 barrels at the end of 1941 to 26,608,000 in 1943. Minor declines in residual-fuel-oil stocks were recorded for the Appalachian, Oklahoma-Kansas, Texas Inland, and Louisiana Gulf districts in 1943. Residual fuel oil stored in the East coast gained about 2,700,000 barrels in 1943, and a second relative important increase was indicated for the Texas Gulf. Some little improvement in quantity was reported in 1943 for small stocks of heavy fuel oil in the Arkansas-Louisiana Inland and Rocky Mountain districts.

No tanker movements of fuel oil from California to the East Coast were reported for either 1942 or 1943. Rail and truck shipments of distillate fuel oil from the California refinery district (California, Oregon, Washington, Arizona, and Nevada) to other Western States of 435,000 barrels in 1943 differed little from the 1942 total of 423,000 barrels, but the movement of residual grades, which has slumped for several years, increased from 49,000 barrels in 1942 to 215,000 in 1943.

Statistics compiled by the Petroleum Industry War Council and the Petroleum Administration for War covering the movement of fuel oil by tanker, barge, rail (tank car), and pipe line from districts 2 and 3 into the East coast show that the total volume of light fuel oil moved increased by 27 percent from 53,066,000 barrels in 1942 to 67,441,000 in 1943 and that the heavy fuel oil handled in this eastward movement was 75,046,000 barrels in 1943—a 9-percent gain over the 1942 total of 68,686,000 barrels. There was a further serious decline in 1943 in the quantities of both light and heavy fuel oils shipped by tanker from the Gulf Coast to the Atlantic seaboard; however, the loss was more than made up by a phenomenal gain in the tank-car transportation of fuel oils from districts 2 and 3 into the Atlantic Coast States. There were other minor movements of fuel oil to eastern areas by barges operating along the Gulf Coast, barges ascending the Mississippi and Ohio River systems, and tankers and barges on the Great Lakes. No pipe line movement of fuel oil into the East Coast was reported in 1943. The detailed quantities of distillate and residual fuel oils handled in 1942 and 1943 by the several methods of transportation are shown in an accompanying table.

Movement of domestic fuel oils into the East coast (district 1) by tanker, barge, rail, and pipe line, 1942–43

[Thousands of barrels]

	Distillate fuel oil		Residual fuel oil	
	1942	1943	1942	1943
Tanker—Gulf coast to East coast	20,341	14,881	27,149	12,996
Railroads—district 2 to East coast	8,329	12,775	14,740	9,125
Railroads—district 3 to East coast	18,951	36,135	23,058	48,910
Barge—Gulf coast to Mississippi-Ohio River points	1,811	1,825	937	365
Barge—Ohio River system to Northeast States	192	365	230	1,095
Tanker and barge—Great Lakes to East coast	2,344	730	2,233	2,190
Barge—Gulf coast to Florida West coast	655	730	339	365
Pipe line to East coast	443			
Total	53,066	67,441	68,686	75,046

Source: Petroleum Industry War Council and Petroleum Administration for War.

Tanker rates for the shipment of fuel oils from the Gulf Coast to the North Atlantic, not east of New York, remained unchanged throughout 1943. Basic rates of 42 cents a barrel for No. 2 light fuel oil and 48 cents a barrel for crude and heavy fuel oil (10°–19.9° gravity) effective since January 19, 1942, were maintained in 1943. A surcharge of 200 percent allowed by the War Shipping Administration "to cover increased wartime operating expenses," starting April 6, 1942, was continued in force all during 1943.

There were relatively few price changes in representative fuel-oil prices in 1943 compared with 1942. The average price of Bunker C fuel oil at New York harbor of $1.61 a barrel for 1942 increased to $1.82 for 1943. The price of $1.65 a barrel dating from September 1942 held until March 9, 1943, when suppliers raised their quotations to range from $1.65 to $2.07 a barrel. This change was made to place prices upon a gravity basis, a departure allowed by Amendment 79 to Revised Price Schedule 88, issued by the Office of Price Administration on March 3, 1943. The new prices ranged from $1.65 a barrel for 9.9° gravity fuel oil to $2.07 for 25.0° gravity. The above schedule of prices for Bunker C at New York harbor remained unchanged until the end of 1943. The New York harbor price of $2.78 a barrel on Diesel fuel for ships' bunkers dating from September 1942 remained at the same level throughout 1943.

Monthly average prices of kerosine and fuel oils in the United States, 1942–43 [1]

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1942													
41°–43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	4.56	4.50	4.45	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.46
Kerosine, tank-wagon at Chicago cents per gallon	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30
No. 2 straw fuel oil at refineries, Oklahoma cents per gallon	3.88	3.87	3.86	3.86	3.86	3.86	3.86	3.86	3.74	3.74	3.75	3.65	3.82
Bunker C for ships:													
New York dollars per barrel	1.37	1.35	1.38	1.56	1.80	1.80	1.80	1.66	1.65	1.65	1.65	1.65	1.61
Gulf coast do	.90	.90	.90	.90	.90	.90	.90	.89	.88	.88	.86	.85	.89
California do	.88	.88	.88	.88	.88	.84	.84	.84	.84	.84	.84	.84	.85
Diesel oil for ships:													
New York dollars per barrel	2.15	2.15	2.18	2.32	2.40	2.48	3.24	2.82	2.78	2.78	2.78	2.78	2.57
Gulf coast do	1.73	1.73	1.64	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.65	1.64
California do	1.40	1.40	1.40	1.40	1.40	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.41
1943													
41°–43° gravity w. w. kerosine refiners, Oklahoma cents per gallon	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.44	4.39	4.38	4.38	4.38	4.42
Kerosine, tank-wagon at Chicago cents per gallon	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
No. 2 straw fuel oil at refineries, Oklahoma cents per gallon	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63
Bunker C for ships:													
New York dollars per barrel	1.65	1.65	1.81	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.82
Gulf coast do	(2)	.85	.98	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.03
California do	.84	.84	.85	.85	.85	1.05	1.10	1.10	1.10	1.10	1.10	1.10	.99
Diesel oil for ships:													
New York dollars per barrel	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
Gulf coast do	(2)	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
California do	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43

[1] Platt's Oil Price Handbook.
[2] No quotations posted.

A price of 85 cents a barrel for Bunker C at Gulf ports, starting in December 1942, was maintained until March 9, 1943, when there was an adjustment to a new schedule—ranging from 85 cents to $1.09 a barrel—based upon the gravity of the product. The monthly average price for Bunker C settled to $1.06 in April, and no changes developed after that month. The quotation of $1.65 a barrel for Diesel bunker fuel at Gulf ports, effective December 1942, was maintained throughout 1943.

Bunker C in California was priced at 84 cents a barrel in June 1942, and no changes were reported until March 12, 1943, when 1 cent a barrel was added. There was a second advance to $1.10 a barrel on June 11, and that quotation remained in force for the balance of 1943. The increases for Bunker C in California in 1943 advanced the average price for the year to 99 cents a barrel compared with 85 cents in 1942. The price of Diesel bunker fuel at California ports ($1.43 a barrel, effective in May 1942) was not changed in 1943.

A quotation for No. 2 straw fuel oil at refineries in Oklahoma (3.63 cents a gallon, starting in December 1942) remained in force throughout 1943.

Monthly retail prices for different fuels in a number of cities are compiled and published by the Bureau of Labor Statistics, United States Department of Labor. The retail price of No. 2 fuel oil in Chicago (7.65 cents a gallon, dating from October 1941) was not changed until December 29, 1942, when a slight advance was made to 7.96 cents a gallon—a quotation that held throughout 1943. The consumer price of No. 2 fuel oil in New York City (8.79 cents a gallon, effective in August 1942) was raised to 9.09 cents a gallon on December 29, 1942, and was kept at that level all during 1943. The 0.3-cent increase in the Chicago and New York retail prices was allowed by the Office of Price Administration in Amendment 15 to Maximum Price Regulation 137 to reimburse dealers for higher fuel-oil handling costs under rationing conditions. The rise in price applied to kerosine, range oil, Nos. 1–6 fuel oils, gas oil, and Diesel fuel sold in 30 Eastern and Midwestern States, where fuel-oil rationing has been in force since October 1, 1942.

LUBRICATING OIL

The total demand for lubricating oil amounted to 40,179,000 barrels in 1941, declined to 37,329,000 barrels in 1942, and rose to 40,322,000 barrels in 1943. Although exports increased from 8,272,000 in 1942 to 8,756,000 in 1943, they were still about 2,000,000 barrels below the pre-war level of 1939.

The domestic demand for lubricating oil, including all consumption by our armed forces, fell from 30,255,000 barrels in 1941 to 29,057,000 barrels in 1942 but rose to 31,566,000 barrels in 1943. The sharp decline in consumption for civilian automotive use in 1942 was continued in 1943 but was more than offset by the steady rise in the demand for industrial and war purposes.

The yield of lubricating oil from crude declined from 2.9 percent in 1942 to 2.7 percent in 1943. Stocks declined by about 1.6 million barrels in 1943. The refinery production of lubricating oil (38,679,000 barrels in 1943) showed virtually no change compared with 1942.

The production of lubricating oil by districts changed materially in 1943 compared with 1942. Production in the East Coast district has fallen from 8.6 million barrels in 1941 to 7.8 million in 1942 and to 7.2 million in 1943. Production in the Appalachian district, after remaining stationary 3 years, dropped to about 5.6 million barrels in 1943—a decline of almost 0.8 million barrels. These decreases were offset by gains in 1943 of 0.7 million barrels in California, of 0.4 million in the Texas Gulf district, of almost 0.4 million in the Illinois-Indiana district, and of about 0.2 million in the Oklahoma-Kansas district.

Comparative analysis of statistics for lubricating oil in the United States, 1942–43, by months and districts

	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]
By months:								
January	3,497	2,935	2.9	2.6	2,674	1,910	8,266	9,725
February	3,174	2,780	3.0	2.7	2,467	2,149	8,429	9,771
March	3,533	3,184	3.2	2.8	2,659	2,672	8,470	9,669
April	3,438	3,107	3.3	2.8	2,767	2,748	8,470	9,474
May	3,439	3,281	3.2	2.8	2,516	2,840	8,768	9,155
June	3,231	3,162	3.1	2.7	2,649	2,849	8,756	8,695
July	3,133	3,257	2.8	2.7	2,008	2,533	8,945	8,412
August	3,141	3,296	2.7	2.6	2,118	2,942	9,301	8,170
September	2,951	3,236	2.6	2.6	2,257	2,784	9,278	7,831
October	3,057	3,635	2.6	2.8	2,111	2,819	9,421	7,712
November	2,983	3,589	2.7	2.8	2,593	2,840	9,336	7,770
December	3,049	3,217	2.7	2.4	2,238	2,480	9,424	7,781
Total United States	38,626	38,679	2.9	2.7	29,057	31,566	9,424	7,781
By districts:								
East Coast	7,798	7,205	4.8	3.7	(2)	(2)	2,579	2,136
Appalachian	6,417	5,652	11.2	10.3			912	646
Indiana, Illinois, Kentucky, etc.	4,326	4,689	1.6	1.8			822	941
Oklahoma, Kansas, and Missouri	4,277	4,451	3.3	3.6			1,007	641
Texas Inland	260	244	.4	.3			70	39
Texas Gulf Coast	9,356	9,745	3.0	2.9			2,123	1,647
Louisiana Gulf Coast	2,066	1,945	3.9	3.4			302	166
Arkansas and Louisiana Inland	1,220	1,153	4.3	4.3			112	79
Rocky Mountain	234	251	.7	.7			120	94
California	2,672	3,344	1.2	1.3			1,377	1,392
Total United States	38,626	38,679	2.9	2.7	29,057	31,566	9,424	7,781

[1] Subject to revision. [2] Figures not available.

Domestic demand for lubricating oil, 1939–43 [1]

[Thousands of barrels]

Year	Automotive				Industrial [2]	Total demand
	Passenger cars	Truck	Busses	Total		
1939	8,028	2,515	205	10,748	12,965	23,713
1940	8,071	2,636	223	10,930	13,760	24,690
1941	8,715	2,722	242	11,679	18,576	30,255
1942	5,916	2,435	279	8,630	20,427	29,057
1943 [3]	4,204	2,250	289	6,743	24,823	31,566

[1] Revised. [2] Includes military. [3] Subject to revision.

Automotive consumption of lubricants in the United States, 1942–43 [1]

[Thousands of barrels]

Use	Passenger cars		Trucks		Busses	
	1942	1943	1942	1943	1942	1943
Crankcase oil	5,424	3,837	2,203	2,031	235	243
Transmission oils	492	367	232	219	44	46
Total lubricating oils	5,916	4,204	2,435	2,250	279	289
Chassis greases	443	330	116	109	12	13
Total lubricants	6,359	4,534	2,551	2,359	291	302

[1] Subject to revision.

Average monthly refinery prices of five selected grades of lubricating oil in the United States, 1942–43, in cents per gallon [1]

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1942													
Oklahoma:													
200 viscosity, No. 3 color, neutral	15.25	15.25	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.04
150–160 viscosity at 210°, bright stock, 10–25 pour test	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	33.00	33.00	33.00	33.00	33.00	33.00	33.00	32.14	30.67	27.27	25.58	24.59	30.94
600 steam-refined, cylinder stock, filterable	15.50	15.18	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.06
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1943													
Oklahoma:													
200 viscosity, No. 3 color, neutral	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
150–160 viscosity at 210°, bright stock, 10–25 pour test	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	24.50	24.50	24.50	24.50	24.50	25.50	26.50	26.50	26.50	27.20	28.80	29.90	26.10
600 steam-refined, cylinder stock, filterable	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

[1] National Petroleum News.

OTHER PRODUCTS

Wax.—A record domestic demand for paraffin wax in 1943, plus increased exports, could not be met by a higher production, so a draft on stocks was necessary. The supply of wax would have been ample for all demands had not imports dwindled almost to the vanishing point.

The domestic demand for wax (585,830,000 pounds in 1943) surpassed by 7 percent the previous record of 546,204,000 pounds reported for 1942, and exports of wax increased by 13 percent from 153,519,000 pounds in 1942 to 172,799,000 in 1943. Imports of wax have dropped in recent years from 16,542,000 pounds in 1941 to 9,749,000 in 1942 and to an unimportant quantity of 109,000 pounds in 1943. Greatly reduced imports of wax in 1943 forced distributors to draw on stocks to make up the deficit; as a result, quantities held in storage declined from 85,400,000 pounds in 1942 to 82,040,000 in 1943. The lower stocks in 1943 are a turn-about from 1942, when about 10,600,000 pounds of wax were added to storage.

Comparative analyses of statistics for wax in the United States, 1942–43, by months and districts

[Thousands of pounds]

Month and district	Production		Domestic demand		Exports		Stocks	
	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]
By months:								
January	55,160	57,680	43,023	44,847	17,617	14,233	72,800	84,000
February	52,920	54,600	38,366	45,875	12,632	11,245	75,600	81,480
March	61,600	65,240	53,515	43,763	13,898	19,517	75,040	83,440
April	52,080	66,920	45,334	49,311	12,218	16,769	69,720	84,280
May	51,800	63,840	43,673	48,879	8,687	13,561	69,160	85,680
June	57,960	60,480	45,768	42,478	11,632	22,202	69,720	81,480
July	50,680	59,920	42,611	49,993	9,749	14,687	68,040	76,720
August	61,040	61,320	44,698	49,342	7,382	15,164	77,000	73,640
September	57,120	62,160	44,027	45,933	12,253	12,307	77,840	77,560
October	75,320	67,200	55,482	54,336	11,438	8,944	86,240	81,480
November	59,920	68,600	41,246	57,180	18,394	11,703	86,520	81,200
December	64,960	67,200	48,461	53,893	17,619	12,467	85,400	82,040
Total United States	700,560	755,160	546,204	585,830	153,519	172,799	85,400	82,040
By districts:								
East Coast	213,640	246,680	(2)	(2)	(2)	(2)	23,520	25,480
Appalachian	119,280	101,080					15,960	15,400
Indiana, Illinois, Kentucky, etc.	57,960	64,680					23,240	16,800
Oklahoma, Kansas, and Missouri	57,960	78,680					3,360	6,720
Texas Inland	3,360	3,080					280	280
Texas Gulf Coast	140,560	143,080					10,920	9,800
Louisiana Gulf Coast	85,400	93,520					560	840
Rocky Mountain	22,400	21,000					7,560	6,720
California	....	3,360					....	....
Total United States	700,560	755,160	546,204	585,830	153,519	172,799	85,400	82,040

[1] Subject to revision.
[2] Figures not available.

Average monthly refinery price of 122°–124° white crude scale wax at Pennsylvania refineries, 1939–43, in cents per pound [1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1939	2.39	2.49	2.60	2.73	2.96	3.00	2.95	2.88	3.47	4.95	6.56	6.75	3.64
1940	6.21	5.57	5.32	4.79	4.69	4.19	2.93	2.21	2.51	2.81	2.93	2.87	3.92
1941	2.73	2.63	2.86	3.28	3.85	4.96	5.13	5.26	5.96	6.25	6.21	4.25	4.45
1942	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1943	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25

[1] National Petroleum News.

Production of paraffin wax showed an 8-percent gain from 700,560,000 pounds in 1942 to 755,160,000 in 1943. All refinery areas reported increased production of wax in 1943 except the Appalachian, Texas Inland, and Rocky Mountain. The output in the Appalachian area, an important source of supply, declined 15 percent. The two most important districts for wax production, the East Coast and Texas Gulf Coast, showed increased outputs by 16 and 2 percent, respectively. California again became a source of wax in 1943, with a production of 3,360,000 pounds.

Office of Price Administration regulations kept paraffin-wax prices at the same levels in 1942 and 1943. White crude scale wax, melting point 122°–124°, was quoted on the New York market in 1943 at 4.25 cents a pound. Fully refined wax of 128°–130° melting point was 5.6 cents a pound, while the same quality wax of 135°–137° melting point sold at 6.4 cents a pound.

Coke.—A higher output of petroleum coke in 1943 was sufficient to satisfy a slightly expanded demand plus an addition to storage. The production of coke increased by 4 percent—from 1,338,400 short tons in 1942 to 1,388,400 in 1943. There was a corresponding percentage increase (4 percent) in the domestic demand—1,046,400 short tons in 1943 compared with 1,007,300 in 1942—but export requirements declined from 325,300 short tons in 1942 to 317,600 in 1943. Year-end stocks of coke—at a very low level in 1941—increased by 3 percent in 1942 and by 10 percent in 1943 or from 233,800 short tons in 1942 to 258,200 in 1943.

Only three refinery districts produce important quantities of petroleum coke. The Indiana-Illinois district is outstanding and reported 61 percent of the national total in 1943. The Texas Gulf Coast rated second, with 13 percent of the total, and the Oklahoma-Kansas area third, with 9 percent of the output. The Oklahoma-Kansas district was the only one of the three areas to show a decline in coke production in 1943.

Comparative analyses of statistics for petroleum coke in the United States, 1942–43, by months and districts

	Production (thousands of short tons)		Yield (percent)		Domestic demand (thousands of short tons)		Stocks (thousands of short tons)	
	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]	1942	1943 [1]
By months:								
January	139.8	113.0	0.6	0.5	115.2	61.0	245.8	273.2
February	121.2	93.4	.6	.5	97.3	77.1	258.8	276.4
March	108.4	98.0	.5	.4	103.5	56.3	252.4	294.2
April	91.4	102.2	.4	.5	113.1	56.4	201.0	310.0
May	83.4	105.0	.4	.4	75.0	62.1	191.2	314.8
June	87.6	115.2	.4	.5	78.9	77.4	181.8	324.6
July	101.0	113.0	.5	.5	74.7	64.9	175.0	339.6
August	110.8	121.6	.5	.5	77.0	78.7	179.0	355.0
September	108.0	133.8	.5	.5	81.9	106.3	172.8	357.0
October	123.0	131.2	.5	.5	82.6	99.2	183.6	354.8
November	122.0	136.4	.5	.5	57.8	134.8	197.6	325.0
December	141.8	125.6	.6	.5	50.3	172.2	233.8	258.2
Total United States	1,338.4	1,388.4	5	.5	1,007.3	1,046.4	233.8	258.2
By districts:								
East Coast	2.4	2.6	(2)	(2)	(3)	(3)	1.8	2.0
Appalachian	25.2	22.2	.2	.2			2.6	5.6
Indiana, Illinois, Kentucky, etc.	847.2	850.0	1.6	1.6			81.6	120.4
Oklahoma, Kansas, and Missouri	144.0	118.2	.6	.5			29.2	43.8
Texas Inland	75.0	91.8	.5	.6			48.6	30.0
Texas Gulf Coast	141.6	179.2	.2	.3			26.6	26.6
Louisiana Gulf Coast	16.2	57.8	.1	.5			1.2	.6
Rocky Mountain	37.6	37.8	.5	.5			20.0	16.0
California	49.2	28.8	.1	.1			22.2	13.2
Total United States	1,338.4	1,388.4	.5	.5	1,007.3	1,046.4	233.8	258.2

[1] Subject to revision.
[2] Less than 0.1 percent.
[3] Figures not available.

Asphalt and road oil.—The domestic demand for petroleum asphalt increased from 6,496,900 short tons in 1942 to 6,558,200 in 1943, and export requirements of 159,200 short tons in 1943 were 40 percent over the 1942 total of 113,800 short tons. Refiners produced 6,756,700 short tons of asphalt in 1943, or 7 percent more than the 1942 total (6,296,500 short tons). Imports of petroleum asphalt declined for the second consecutive year, dropping to 113,000 short tons in 1943 compared with 121,200 in 1942. Stocks of asphalt were 563,300 short tons at the end of 1943 compared with 411,000 for 1942.

The heavy demand for residual fuel oil and curtailed road construction and repair in 1943 were reflected in a greatly reduced production of road oil—the output declining from 8,039,000 barrels in 1942 to 2,295,000 in 1943. The domestic demand for road oil dropped proportionally from 8,484,000 barrels in 1942 to 2,450,000 in 1943, and stocks declined from 348,000 barrels at the end of 1942 to 193,000 for 1943.

Detailed statistics for asphalt and road oil appear in a separate chapter on Asphalt and Related Bitumens.

Production of still gas in the United States, 1941–43, by districts

District	1941		1942		1943 [1]	
	Millions of cubic feet	Equivalent, in thousands of barrels	Millions of cubic feet	Equivalent, in thousands of barrels	Millions of cubic feet	Equivalent, in thousands of barrels
East Coast	42,192	11,720	37,530	10,425	44,449	12,347
Appalachian	10,065	2,796	9,961	2,767	10,249	2,847
Indiana, Illinois, Kentucky, etc.	56,336	15,649	56,398	15,666	57,855	16,071
Oklahoma, Kansas, and Missouri	27,727	7,702	25,657	7,127	24,059	6,683
Texas Inland	16,913	4,698	15,797	4,388	14,080	3,911
Texas Gulf Coast	95,404	26,501	85,338	23,705	96,235	26,732
Louisiana Gulf Coast	8,485	2,357	10,105	2,807	17,824	4,951
Arkansas and Louisiana Inland	4,406	1,224	3,614	1,004	4,280	1,189
Rocky Mountain	5,872	1,631	5,555	1,543	5,422	1,506
California	32,674	9,076	34,171	9,492	37,865	10,518
Total United States	300,074	83,354	284,126	78,924	312,318	86,755

[1] Subject to revision.

Still gas.—The production of still gas increased by 10 percent from 284,126 million cubic feet in 1942 to 312,318 in 1943. Refiners used as fuel at their plants 259,316 million cubic feet of still gas in 1942, or 91 percent of the production. The larger quantities of still gas were produced in the following refinery districts, in the order of importance: Texas Gulf Coast, Indiana, Illinois, Kentucky, etc., East Coast, and California.

Miscellaneous oils.—The domestic demand for this group of products has risen steadily from 11,862,000 barrels in 1941 to 14,547,000 barrels in 1942 and 18,395,000 barrels in 1943. About half the total supply comes from refineries, and the remainder represents transfers of liquefied petroleum gases from natural-gasoline and cycle plants that are not included in mortor-fuel demand but classed as sold for fuel uses. Refinery production amounted to 8,117,000 barrels in 1942 and 9,660,000 barrels in 1943, and transfers rose from 7,195,000 barrels in 1942 to 9,699,000 in 1943. The refinery output by products is shown for 1941 and 1942 but is not available for 1943.

Production of miscellaneous oils in the United States, 1941–42, by districts and classes [1]

[Thousands of barrels]

District	Petrolatum	Absorption oil	Medicinal oil	Specialties	Liquefied gas	Other	Total
1941							
East Coast	79	6	211	8	1,163	107	1,574
Appalachian	239	10		15		31	295
Indiana, Illinois, Kentucky, etc	47			46	1,025	95	1,213
Oklahoma, Kansas, and Missouri	51	42			71	12	176
Texas Inland		31			89	26	146
Texas Gulf Coast	10			70		46	126
Louisiana Gulf Coast	36				90	32	158
Arkansas and Louisiana Inland					14	19	33
Rocky Mountain		14			23	19	56
California		58	47	57	2,280	47	2,489
Total United States	462	161	258	196	4,755	434	6,266
1942							
East Coast	69	9	70		1,438	200	1,786
Appalachian	267	15		6		159	447
Indiana, Illinois, Kentucky, etc	15			66	1,115	379	1,575
Oklahoma, Kansas, and Missouri	41	39			75	59	214
Texas Inland		26			112	98	236
Texas Gulf Coast	49			64	392	101	606
Louisiana Gulf Coast	29				425	24	478
Arkansas and Louisiana Inland					61	25	86
Rocky Mountain	6	9			28	30	73
California		58	35	92	2,267	164	2,616
Total United States	476	156	105	228	5,913	1,239	8,117

[1] Detailed figures for 1943 not yet available.

WORLD PRODUCTION[2]

Regained control over the sealanes permitted the production of crude petroleum in the principal United Nations to recover to such an extent that the world output in 1943 was 7 percent higher than in 1942 and exceeded slightly the 1941 output, which held the previous record. The increase was due largely to the 8-percent augmented yield in the United States, which comprised 67 percent of the total in 1942 and 68 percent in 1943. Other North American countries either maintained a stationary output or decreased from 1942 to 1943.

In South America, Venezuela and Colombia increased their petroleum production in 1943 over 1942; but neither attained the level of 1941. Argentina and Peru enlarged their output in 1943 compared with 1942.

Little authentic information is available on petroleum production in Europe; but such data as are at hand indicate greater production in Germany and in Hungary in 1943 than in 1942. Allied air attacks and the continued exhaustion of old fields reduced the production in Rumania. The ravages of war and disorganization of transport are believed to have reduced crude-oil output in the U. S. S. R. from 1942 to 1943.

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[2] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

In Asia, Bahrein Island raised its petroleum production in 1943 but not to the level that prevailed in 1939. The output of Saudi Arabia definitely declined in 1943. Iranian production was a little larger in 1943 than in 1942. Recovered control of the Mediterranean by the United Nations and the reopening of the northern fork of the pipe line permitted Iraq nearly to double in 1943 its output of 1942 and to approximate its pre-war output. In the course of 2 years' uninterrupted control, the Japanese invaders are believed to have restored to a limited extent at least the petroleum production of the Netherlands East Indies and of Sarawak and Brunei.

In Egypt the output of the Ras Gharib field raised the national production to nearly twice the quantity produced in 1939.

Crude petroleum produced in principal countries of the world, 1939–43, in thousands of barrels

[Compiled by B. B. Waldbauer]

Country	1939	1940 [1]	1941 [1]	1942 [1]	1943 [1]
North America:					
Canada	7,838	8,591	10,134	10,365	9,958
Mexico	42,898	44,036	42,196	35,152	35,213
Trinidad	19,270	20,219	21,211	25,700	21,385
United States	1,264,962	1,353,214	1,402,228	1,386,645	1,503,176
Other North America	112	142	150	150	150
Total North America	1,335,080	1,426,202	1,475,919	1,458,012	1,569,882
South America:					
Argentina	18,613	20,609	21,873	23,704	24,707
Bolivia	215	288	235	308	231
Brazil	----------	2	3	31	80
Colombia	23,857	25,593	24,553	10,487	13,261
Ecuador	2,313	2,349	1,557	2,278	2,378
Peru	13,508	12,126	11,935	13,629	14,654
Venezuela	206,470	185,570	228,430	147,675	177,631
Total South America	264,976	246,537	288,586	198,112	232,942
Europe:					
Albania	934	1,497	1,381	2,002	1,100
Czechoslovakia	120	163	183	271	200
France	500	496	479	500	600
Germany	4,487	4,544	4,438	4,500	6,500
Austria	693	719	692	740	1,500
Hungary	1,103	1,755	2,474	4,000	9,700
Italy	91	57	77	77	75
Poland	3,898	3,891	3,319	3,400	3,500
Rumania	45,648	42,644	41,092	39,155	36,500
U. S. S. R.[2]	216,866	218,600	238,150	227,470	200,750
United Kingdom	----------	----------	----------	----------	825
Other Europe	10	10	10	10	10
Total Europe [3]	274,350	274,376	292,295	282,125	261,260
Asia:					
Bahrein Island	7,589	7,074	6,794	6,241	6,572
Burma	7,873	7,731	7,762	2,500	1,000
China [3]	----------	4	10	89	100
India, British	2,327	2,250	3,571	2,500	2,748
Iran (Persia)	78,151	66,221	50,722	73,350	73,766
Iraq	30,791	24,225	12,650	14,700	27,095
Japan (including Taiwan)	2,654	2,639	2,659	3,000	3,500
Netherlands Indies	62,087	62,011	53,704	9,000	20,000
Sakhalin	[4] 4,000	4,000	4,000	4,000	5,000
Sarawak and Brunei	7,097	7,047	6,864	3,000	4,500
Saudi Arabia	3,934	5,365	5,871	6,000	4,865
Total Asia [5]	206,503	188,567	154,607	124,380	149,146

See footnotes at end of table.

Crude petroleum produced in principal countries of the world, 1939–43, in thousands of barrels—Continued

Country	1939	1940[1]	1941[1]	1942[1]	1943[1]
Africa:					
Egypt	4,666	6,505	8,546	8,275	8,953
Other Africa	27	27	27	27	25
Total Africa	4,693	6,532	8,573	8,302	8,978
Australia and New Zealand	3	3	3	3	5
Undistributed	4	14	14	15	15
Grand total	2,085,609	2,142,231	2,219.997	2,070,949	2,222,228

[1] Approximate production. Data derived in part from World Petroleum, vol. 12, No. 2, February 1941, pp. 20–21, vol. 13, No. 3, March 1942, p. 88, and the Oil Weekly, vol. 112, No. 9, January 31, 1944.

[2] Includes U. S. S. R. fields in Asia, other than Sakhalin.

[3] Unoccupied China.

[4] Approximate production.

[5] Exclusive of U. S. S. R. fields in Asia, other than Sakhalin, which are included with U. S. S. R. in Europe.

FOREIGN TRADE[3]

IMPORTS

Imports of mineral oils, crude and refined, into continental United States increased 77 percent from 1942 to 1943. They constituted 2 percent of the total new supply in continental United States in 1942 and 4 percent in 1943.

Crude petroleum, residual fuel oil, and distillate fuel oil made up 96 percent (revised figure) of the total imports in 1942 and 89 percent in 1943. Venezuela supplied 55 percent of the crude petroleum imported in 1942 and 68 percent in 1943; Colombia 18 percent in 1942 and 22 percent in 1943; and Mexico 27 percent in 1942 but only 10 percent in 1943. Of the residual fuel oil imported in 1942, the Netherlands West Indies furnished 90 percent and Venezuela 5 percent. In 1943 the Netherlands West Indies shipped 95 percent and Trinidad 4 percent of the residual fuel oil imported into continental United States. Of the distillate fuel oil imported, the Netherlands West Indies sent 53 percent in 1942 but 84 percent in 1943; Venezuela 25 percent in 1942 but only 7 percent in 1943; and Mexico 18 percent in 1942 but only 6 percent in 1943. Altogether, the Netherlands West Indies supplied 73 percent of all mineral oils imported into continental United States in 1943; Venezuela 16 percent; Colombia 5 percent; Mexico 4 percent; and Trinidad 3 percent.

The greatest gains were in imports of distillate fuel oil, of residual fuel oil, and of gasoline. Of the gasoline imported in 1943, the Netherlands West Indies provided 88 percent; Trinidad 7 percent; and Peru 5 percent.

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[3] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

Mineral oils, crude and refined, imported into continental United States, 1942–43 by months [1]

[Thousands of barrels]

Class	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1942													
Crude petroleum	3, 554	3, 068	2, 058	1, 109	849	540	135	315	236	111	74	248	12, 297
Refined products:													
Gasoline, finished	14	85	-----	-----	-----	12	-----	-----	-----	4	-----	-----	115
Kerosine	-----	121	32	261	-----	-----	-----	-----	-----	-----	-----	4	418
Distillate fuel oil	403	369	407	92	296	215	30	152	98	422	619	533	3, 636
Residual fuel oil	3, 357	3, 297	2, 724	1, 483	858	678	746	495	456	1, 882	1, 247	1, 210	18, 433
Paraffin wax	12	3	19	1	-----	-----	-----	-----	-----	-----	-----	-----	35
Asphalt	83	13	253	57	1	1	2	61	1	102	55	38	667
Unfinished oils, other	63	121	61	-----	-----	-----	-----	-----	-----	89	32	-----	366
	7, 486	7, 077	5, 554	3, 003	2, 004	1, 446	913	1, 023	791	2, 610	2, 027	2, 033	35, 967
1943 [2]													
Crude petroleum	254	-----	138	179	72	454	122	2, 036	1, 568	2, 797	2, 740	3, 473	13, 833
Refined products:													
Gasoline, finished	-----	-----	2	110	85	1, 400	1, 049	1, 703	176	898	177	136	5, 736
Kerosine	-----	-----	-----	-----	15	98	-----	167	-----	19	76	-----	375
Distillate fuel oil	181	432	170	612	499	5, 016	2, 202	3, 548	978	953	1, 065	343	15, 999
Residual fuel oil	537	1, 488	252	1, 795	3, 460	3, 355	3, 007	4, 259	1, 566	2, 653	2, 204	1, 991	26, 567
Asphalt	46	69	35	49	51	51	50	1	91	-----	88	92	623
Unfinished oils, other	-----	-----	-----	-----	-----	-----	-----	-----	98	-----	268	-----	366
	1, 018	1, 989	597	2, 745	4, 182	10, 374	6, 430	11, 714	4, 477	7, 320	6, 618	6, 035	63, 499

[1] Imports of crude as reported to Bureau of Mines; imports of refined products compiled from data of U. S. Department of Commerce; figures may differ slightly from those used throughout other sections of this report.

[2] Subject to revision.

EXPORTS

Continental United States continued to be a net exporter of mineral oils. The excess of petroleum exports over petroleum imports increased from 80,940,000 barrels in 1942 to 85,135,000 barrels in 1943. Although the excess of exports of crude petroleum increased from 21,537,000 barrels in 1942 to 24,508,000 barrels in 1943, the excess of exports of refined oils increased from 59,403,000 barrels in 1942 to 60,627,000 barrels in 1943. Of the refined oils, only residual fuel oil showed greater imports than exports. Imports of residual fuel oil exceeded exports by 6,338,000 barrels in 1942 and by 9,801,000 barrels in 1943.

In absolute amounts, exports and Territorial shipments of mineral oils, both crude and refined, were 27 percent larger in 1943 than in 1942. The principal gains were in outward shipments of motor fuel. This was followed, in order of importance, by residual fuel oil, crude petroleum, and distillate fuel oil.

Of the exports of major refined mineral oils, 63 percent in 1942 and 70 percent in 1943 went to Europe. The United Kingdom received 60 percent of the total in 1942 and 67 percent in 1943; and the U. S. S. R. most of the remainder.

The Southwest Pacific region was the second most important destination of major refined oils exported from continental United States. Australia received 6 percent of the total exports in 1942 and 12 percent in 1943. New Zealand received 3 percent in both years.

Exports to other North American countries declined from 19 percent of the total in 1942 to 8 percent in 1943. Canada received 8 percent of the whole in 1942 and 5 percent in 1943.

Major petroleum products shipped from continental United States by countries of destination and shipments to and exports from noncontiguous Territories, 1941–43 [1]

[Thousands of barrels, except wax, which is in thousands of pounds]

Country	Motor fuel [2]			Kerosine			Fuel oil			Lubricating oil			Wax		
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
Exports to foreign countries:															
North America:															
Bermuda	63	62	(3)	20	25	(3)	33	135	-------	6	8	2	44	1	(4)
Canada	2,692	3,112	2,964	57	236	269	1,681	1,764	1,330	445	464	378	20,556	18,106	22,441
Cuba	563	526	303	1	(3)	(3)	1,132	1,258	730	76	77	52	3,188	3,311	2,117
Curaçao (N. W. I.)	331	168	(3)	74	(3)	-------	175	368	-------	28	21	53	3	5	1
Mexico	819	490	603	38	44	61	675	563	723	136	162	200	35,270	5,529	5,581
Panama: Canal Zone	508	516	44	57	52	-------	1,857	2,188	47	15	25	9	28	8	-------
Trinidad and Tobago	4	(3)	(3)	(3)	(3)	(3)	-------	(3)	-------	39	60	26	122	45	171
Other North America	386	342	200	106	47	33	870	836	91	102	113	92	7,121	2,508	3,355
	5,366	5,216	4,114	352	404	363	6,423	7,112	2,921	847	930	812	66,332	29,513	33,666
South America:															
Argentina	13	3	(3)	(3)	(3)	-------	(3)	2	38	24	18	13	8,030	1,889	51
Bolivia	13	67	14	1	1	3	85	9	(3)	19	16	20	3,286	572	1,353
Brazil	416	127	53	223	57	22	123	20	70	412	298	241	3,013	1,833	1,285
Chile	16	11	5	(3)	-------	(3)	2,483	82	28	112	80	70	9,737	2,528	5,985
Colombia	-------	4	3	(3)	-------	-------	3	(3)	-------	30	9	22	9,146	4,186	5,515
Peru	6	42	10	(3)	-------	(3)	(3)	-------	(3)	32	29	30	4,859	1,624	1,932
Surinam	-------	(3)	(3)	7	4	(3)	60	28	(3)	4	8	3	13	25	30
Uruguay	-------	(3)	2	(3)	-------	(3)	1	-------	2	51	33	25	355	285	199
Venezuela	17	15	3	3	2	-------	(3)	-------	-------	62	34	44	4,374	1,220	1,881
Other South America	19	4	2	1	-------	-------	25	2	1	24	24	21	2,575	1,358	1,382
	500	273	92	235	64	25	2,780	143	139	770	549	489	45,388	15,520	19,613
Europe:															
Azores and Madeira Islands	13	-------	(3)	-------	-------	-------	65	-------	-------	(3)	-------	(3)	-------	173	-------
Eire	36	43	-------	39	42	-------	15	-------	-------	1	1	-------	2,665	2,172	2,325
Finland	190	-------	-------	18	-------	-------	34	-------	-------	12	-------	-------	307	-------	-------
Portugal	13	3	4	1	1	(3)	-------	59	1	3	13	40	1,441	121	683
Spain	499	-------	-------	66	-------	-------	874	82	(3)	190	25	95	4,366	8	1,729
Sweden	106	265	-------	-------	-------	-------	235	363	(3)	19	32	52	1,234	222	22
U. S. S. R.	2,107	879	2,709	1	7	17	341	84	264	97	115	62	-------	843	5,979
United Kingdom	11,124	20,495	31,063	1,941	1,671	3,782	8,700	18,297	27,480	3,210	3,050	2,969	77,274	95,795	76,544
Other Europe	6	-------	94	2	-------	-------	694	4	-------	48	2	5	1,024	349	-------
	14,094	21,685	33,870	2,068	1,721	3,799	10,968	18,889	27.745	3,580	3,238	3,223	88,311	99,683	87,282

See footnotes at end of table.

Major petroleum products shipped from continental United States by countries of destination and shipments to and exports from noncontiguous Territories, 1941–43 [1]—Continued

[Thousands of barrels, except wax, which is in thousands of pounds]

Country	Motor fuel [2]			Kerosine			Fuel oil			Lubricating oil			Wax		
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
Asia:															
British Malaya	227	-------	-------	1	(3)	-------	10	-------	-------	180	9	-------	233	-------	-------
China and Hong Kong	387	-------	(3)	(3)	-------	-------	251	-------	-------	384	36	17	1,949	2	-------
India and Dependencies	-------	189	4	(3)	40	(3)	29	2	1	488	926	1,133	621	10	138
Iran	2	(3)	(3)	-------	-------	-------	-------	-------	-------	13	149	62	880	-------	-------
Iraq	-------	-------	-------	-------	-------	-------	-------	-------	1	33	89	77	-------	-------	6
Japan and Kwantung	2,246	-------	-------	87	-------	-------	3,821	-------	-------	897	-------	-------	210	-------	-------
Philippine Islands	451	-------	-------	80	-------	-------	630	-------	-------	148	(3)	-------	491	-------	-------
Other Asia	81	-------	-------	1	-------	(3)	39	-------	(3)	260	112	151	740	46	301
	3,394	189	4	169	40	(3)	4,780	2	2	2,403	1,321	1,440	5,124	58	445
Africa:															
Belgian Congo	2	(3)	50	-------	-------	4	-------	8	13	41	76	35	56	11	46
Egypt	26	2,245	1,637	(3)	(3)	(3)	-------	(3)	-------	447	719	634	57	1,204	162
Gold Coast	26	110	128	5	(3)	22	15	4	56	18	45	27	-------	(4)	-------
Liberia	14	49	3	3	2	1	10	4	(3)	3	2	1	135	8	66
Morocco	91	(3)	-------	87	-------	-------	143	-------	-------	6	1	(3)	1,867	-------	(4)
Union of South Africa	165	203	(3)	4	(3)	(3)	1	228	116	328	186	356	4,818	5,091	19,239
Other Africa	85	77	-------	9	2	(3)	8	8	-------	117	140	249	384	56	920
	409	2,684	1,818	108	4	27	177	247	185	960	1,169	1,302	7,317	6,370	20,433
Oceania:															
Australia	270	2,451	7,433	31	179	166	43	1,004	3,389	708	681	1,082	10	1,296	5,780
British Oceania	37	48	19	9	8	8	30	56	2	3	6	2	-------	-------	-------
New Zealand	201	471	1,125	12	73	45	63	1,362	1,735	115	77	188	357	1,005	5,580
Other Oceania	26	14	15	7	6	5	10	5	8	7	3	4	-------	-------	-------
	534	2,984	8,592	59	266	224	146	2,427	5,134	833	767	1,276	367	2,301	11,360
	24,297	33,031	48,490	2,991	2,499	4,438	25,264	28,820	36,126	9,393	7,974	8,542	212,839	153,445	172,799

Shipments to noncontiguous Territories:															
Alaska	407	680	940				1,760	1,285	1,391	364	145	223			
Hawaii	1,661	1,450	2,645	98	12	223	3,665	3,514	2,531	151	78	92	57	65	70
Puerto Rico	752	3	3	141	5	(3)	357	126	2	177	45	33	187	54	92
Virgin Islands	33	37	22	4	6	6	10	8	18	2	5	1	1	1	(4)
Other	32	(3)		4	(3)		(3)			(3)	(3)				
	2,885	2,170	3,610	247	23	229	5,792	4,933	3,942	694	273	349	245	120	162
Exports from noncontiguous Territories:															
Alaska	16	46	10				15	6	7		1				
Hawaii										1					
Puerto Rico	78	35	26	19	7	6	24	10	8	2			11	33	
	94	81	36	19	7	6	39	16	15	3	1		11	33	
Total shipments from United States	27,088	35,120	52,064	3,219	2,515	4,661	31,017	33,737	40,053	10,084	8,246	8,891	213,073	153,532	172,961

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[1] Compiled from the records of the U. S. Department of Commerce.

[2] Includes natural gasoline, naphtha, benzol, and antiknock compounds.

[3] Less than 1,000 barrels.

[4] Less than 1,000 pounds.

Mineral oils, crude and refined, shipped from continental United States and including shipments to noncontiguous Territories, 1942–43, by classes and months[1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1942													
Crude petroleum	1,522	1,336	1,887	2,973	3,709	3,591	3,370	4,073	3,240	3,264	2,826	2,043	33,834
Refined products:													
Motor fuel[2]	3,030	2,043	2,912	2,870	2,113	3,412	3,206	2,908	1,924	3,834	3,320	3,525	35,097
Kerosine	393	196	261	368	82	204	378	61	212	244	79	98	2,576
Distillate fuel oil	1,131	1,070	1,691	1,880	1,171	1,891	3,466	1,602	1,820	2,497	1,344	2,012	21,575
Residual fuel oil	1,672	517	1,038	862	1,366	1,050	626	1,101	988	881	740	1,254	12,095
Lubricating oil	684	544	833	671	625	594	936	667	717	803	475	723	8,272
Paraffin wax	63	45	50	43	31	41	35	26	44	41	66	63	548
Coke	34	55	57	149	91	91	165	149	161	148	251	276	1,627
Asphalt	62	84	95	19	39	91	58	54	51	26	17	30	626
Miscellaneous oils	53	62	51	60	43	49	43	63	51	54	52	76	657
Total refined	7,122	4,616	6,988	6,922	5,561	7,423	8,913	6,631	5,968	8,528	6,344	8,057	83,073
Total crude and refined	8,644	5,952	8,875	9,895	9,270	11,014	12,283	10,704	9,208	11,792	9,170	10,100	116,907
1943[3]													
Crude petroleum	2,031	1,781	2,618	2,877	4,389	3,876	4,597	3,862	3,441	3,370	3,415	2,084	38,341
Refined products:													
Motor fuel[2]	3,131	2,326	2,873	3,111	4,108	4,222	6,113	5,975	6,972	4,816	4,095	3,639	51,381
Kerosine	348	178	357	486	296	223	677	735	810	93	359	57	4,619
Distillate fuel oil	1,442	1,570	1,905	2,295	2,455	2,319	3,493	2,737	1,934	1,772	1,308	1,632	24,862
Residual fuel oil	1,248	1,076	1,068	1,669	1,876	908	2,290	2,082	733	1,528	1,032	1,256	16,766
Lubricating oil	724	585	594	574	760	773	1,007	596	791	935	691	726	8,756
Paraffin wax	51	40	70	60	48	79	52	54	44	32	42	45	618
Coke	63	65	120	150	190	140	165	138	128	171	157	101	1,588
Asphalt	17	30	58	72	102	88	187	92	92	17	59	63	876
Miscellaneous oils	44	69	69	56	144	50	64	55	58	68	71	79	827
Total refined	7,068	5,939	7,114	8,473	9,979	8,802	14,048	12,464	11,562	9,432	7,814	7,598	110,293
Total crude and refined	9,099	7,720	9,732	11,350	14,368	12,678	18,645	16,326	15,003	12,802	11,229	9,682	148,634

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[1] Compiled from the records of the Department of Commerce; figures may differ slightly from those used throughout other sections of this report.

[2] Includes benzol, natural gasoline, and antiknock compounds.

[3] Subject to revision.

INTERCOASTAL SHIPMENTS [4]

Receipts of mineral oils, crude and refined, on the East Coast from Gulf Coast ports were only 56 percent as large in 1943 as in 1942 and only 16 percent as large as in 1941. Gasoline was the largest single item in these shipments and constituted 44 percent of the total shipments in 1943. However, shipments of gasoline from Gulf Coast to East Coast ports were 11 percent smaller in 1943 than in 1942. Intercoastal shipments of residual fuel oil declined 52 percent, of distillate fuel oil 27 percent, and of kerosine 43 percent from 1942 to 1943. Shipments of crude petroleum from Gulf Coast to East Coast ports in 1943 were only 17 percent of the quantity shipped in 1942 and only 3 percent of that shipped in 1941.

Mineral oils, crude and refined, shipped from Gulf Coast to East Coast ports of the United States, 1942–43, by classes [1]

[Thousands of barrels]

Class	1943						
	Jan.	Feb.	Mar.	Apr.	May	June	July
Crude petroleum	602	638	447	63	282	630	----------
Gasoline	1,775	1,299	1,587	2,456	2,697	2,807	2,392
Kerosine	388	287	325	288	213	127	547
Distillate fuel oil	640	1,324	629	155	385	354	908
Residual fuel oil	648	1,053	1,000	1,067	919	921	1,124
Lubricating oil	----------	----------	----------	----------	----------	----------	3
Miscellaneous oils	55	54	77	76	136	146	34
	4,108	4,655	4,065	4,105	4,632	4,985	5,008

Class	1943						1942 (total)
	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Crude petroleum	557	511	910	302	166	5,108	30,803
Gasoline	2,979	2,805	2,873	3,108	3,279	30,057	33,752
Kerosine	180	596	667	638	859	5,115	9,000
Distillate fuel oil	845	1,573	1,698	3,299	3,073	14,883	20,341
Residual fuel oil	1,286	1,240	1,537	1,042	1,159	12,996	27,149
Lubricating oil	----------	----------	----------	----------	----------	3	2,130
Miscellaneous oils	5	84	66	106	12	851	639
	5,852	6,809	7,751	8,495	8,548	69,013	123,814

[1] Petroleum Conservation Division, U. S. Department of the Interior.

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[4] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

NATURAL GAS[1]

By F. S. Lott and H. Backus

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SUMMARY

The dynamic effects of record war production upon the natural-gas industry in 1943 were felt in continued vigorous expansion of markets. Marketed production increased 10 percent over 1942 to a new high of 3,349,586 million cubic feet, according to current estimates. Use by domestic and commercial consumers exceeded 1942 by 7 and 14 percent, respectively, and total industrial requirements were about 10 percent larger.

Unusual gains of 34 and 26 percent in the quantity of gas consumed as fuel at petroleum refineries and public-utility power plants were indicated in 1943 compared with 1942. Conversions to gas from other fuels (chiefly from fuel oil in the Southwest and California) and greater productive activity at these establishments were contributing factors Miscellaneous industrial (including power-plant) consumption increased 15 percent in 1943 to 1,197,305 million cubic feet. Oil- and gas-field use of gas is estimated to have totaled 760 billion cubic feet in 1943 compared with 721.1 billion in 1942.

Carbon-black and portland-cement plants utilized less natural gas in 1943 than in 1942. Gas consumption declined in the carbon-black industry because of higher average yields per thousand cubic feet of gas burned and in the cement industry because of lower production and conversion to other fuels at several plants.

The average value of natural gas at the wells is estimated to have risen from 5.1 cents per thousand cubic feet in 1942 to 5.3 cents in 1943. A trend toward slightly higher average field prices is evident in nearly all producing districts, and this factor is thought to have more than balanced the depressing effect on the United States average of relatively higher production in 1943 from areas where low prices prevail.

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[1] In this report the term "billion" is equivalent to 1,000,000,000 and "trillion" to 1,000,000,000,000.

The average value at points of consumption of all gas marketed was 22.7 cents per thousand cubic feet in 1942 and about 22.6 cents in 1943. The unit value of domestic and commercial gas declined in 1943 as in 1942, influenced primarily by larger average consumption per meter which, under the "block" or "incentive" rate schedules in

Salient statistics of natural gas in the United States, 1939–43

	1939	1940	1941	1942	1943[1]
Marketed production:					
California ....million of cubic feet..	348, 361	351, 950	374, 905.	403, 968	450, 000
Louisiana ....do....	294, 370	343, 191	403, 855	447, 686	490, 000
Oklahoma ....do....	250, 875	257, 626	234, 054	269, 704	292, 000
Texas ....do....	979, 427	1, 063, 538	1, 086, 312	1, 170, 345	1, 320, 000
West Virginia ....do....	159, 226	188, 751	207, 681	215, 193	195, 000
Other States ....do....	444, 497	455, 166	505, 851	546, 579	602, 586
Total production ....do....	2, 476, 756	2, 660, 222	2, 812, 658	3, 053, 475	3, 349. 586
Exports:					
To Canada ....do....	76	90	121	130	133
To Mexico ....do....	3, 046	5, 473	7, 345	8, 572	9, 800
Imports from Canada ....do....	131	....	....	....	....
Consumption:					
Domestic ....do....	391, 153	443, 646	442, 067	498, 537	535, 000
Commercial ....do....	118, 334	134, 644	144, 844	183, 603	210, 000
Industrial:					
Field ....do....	680, 884	711, 861	686, 158	721, 063	760, 000
Carbon-black plants ....do....	347, 270	368, 802	365, 377	335, 533	315, 600
Petroleum refineries ....do....	97, 685	128, 007	148, 127	201, 670	270. 000
Portland-cement plants[2] ....do....	40, 233	41, 949	54, 208	64, 540	51, 748
Other industrial ....do....	798, 206	825, 750	964, 411	1, 039, 827	1, 197, 305
Total consumption ....do....	2, 473, 765	2, 654, 659	2, 805, 192	3, 044, 773	3, 339, 653
Electric public-utility power plants[3] millions of cubic feet..	191, 131	183, 156	205, 156	238, 736	301, 090
Domestic ....percent of total.	16	17	16	16	16
Commercial ....do....	5	5	5	6	6
Industrial ....do....	79	78	79	78	78
Number of consumers:					
Domestic ....thousands..	8, 888	9, 245	9, 730	10, 135	10, 350
Commercial ....do....	715	741	767	779	785
Industrial[4] ....do....	40	41	43	41	42
Number of producing gas wells	53, 530	53, 880	55, 500	56, 150	([5])
Value (at wells) of gas produced:					
Total ....thousands of dollars..	120, 243	120, 493	138, 508	154, 236	177, 500
Average per M cubic feet ....cents..	4. 9	4. 5	4. 9	5. 1	5. 3
Value (at points of consumption) of gas consumed:					
Domestic ....thousands of dollars..	287, 600	315, 515	318, 093	352, 520	374, 500
Commercial ....do....	58, 494	64, 399	68, 398	80, 189	88, 830
Industrial ....do....	187, 627	197, 090	233, 547	258, 458	290, 480
Total value ....do....	533, 721	577, 004	620, 038	691, 167	753, 810
Average per M cubic feet:					
Domestic ....cents..	73. 5	71. 1	72. 0	70. 7	70. 0
Commercial ....do....	49. 4	47. 8	47. 2	43. 7	42. 3
Industrial ....do....	9. 6	9. 5	10. 5	10. 9	11. 2
Domestic and commercial ....do....	67. 9	65. 7	65. 9	63. 4	62. 2
Domestic, commercial, and industrial cents..	21. 6	21. 7	22. 1	22. 7	22. 6
Treated for natural gasoline:					
Quantity ....millions of cubic feet..	2, 150, 000	2, 471, 400	2, 763, 300	2, 864, 400	2, 900, 000
Ratio to total consumption	87	93	99	94	87

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[1] Subject to revision.
[2] Chapters on Cement in Minerals Yearbook.
[3] Federal Power Commission: Figures include gas other than natural, impossible to segregate; therefore shown separately from main table.
[4] Exclusive of oil- and gas-field operators.
[5] Figures not yet available.

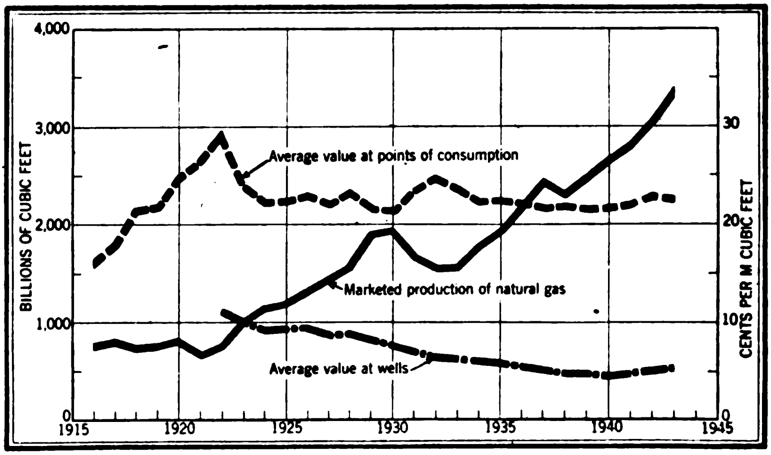

FIGURE 1.—Production and value of natural gas in the United States, 1916–43.

common use, has the effect of reducing average unit costs. The average value of all industrial gas sold increased from 9.5 cents per thousand cubic feet in 1940 to 10.9 cents in 1942 and continued upward to about 11.2 cents in 1943.

Exports to Mexico, largely to the vicinity of Monterey, reached a new high in 1943 at about 9.8 billion cubic feet, a 14-percent increase over 1942. The small movement of natural mixed with manufactured gas from New York State to Ontario, Canada, amounted to 133 million cubic feet in 1943 and 130 in 1942.

The total of all classes of natural-gas consumers increased 2 percent in 1943 to about 11,177,000.

FEDERAL LAW AND ADMINISTRATION

Recent decisions of the United States Supreme Court will dictate fundamental changes in the methods and concepts of utility rate regulation. These decisions are described by the Federal Power Commission as "the most important pronouncements of the Supreme Court in the field of regulatory law in several decades."[3] The concepts of "fair value" and "reproduction cost" are no longer required as factors in establishing a rate base. As a result, proceedings in rate cases will be expedited by the elimination of many technicalities, and regulatory agencies will exercise their discretion and judgment in a broader field.

The Office of War Utilities was established on February 5, 1943, as an adjunct of the War Production Board. Its chief functions are to determine in advance the essential requirements of gas and to arrange, in cooperation with the Federal Power Commission and the Natural Gas and Natural Gasoline Division of the Petroleum Administration for War for such added supplies and facilities as may be needed to satisfy them.

The Director of the Office of War Utilities was authorized by the War Production Board to prohibit delivery of gas to such industrial plants as failed to provide stand-by facilities and fuel or to convert gas-fired equipment to less critical fuels when practicable. The use of some strategic mineral products was restricted, and materials for repairs, maintenance, and extension of plant were limited by a system of allotments. Late in 1943, however, a tendency developed toward more liberal allotments of certain steel products. More latitude in drilling new wells was permitted in Michigan, eastern Kansas, southern Oklahoma, and north and west central Texas by supplementary orders of the Petroleum Administration for War.

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[3] Federal Power Commission, The First Five Years under the Natural Gas Act: 1944, p. 3.

The Office of Price Administration required prior notice from utilities of all proposed changes in rates. On June 15, 1943, this office rationed stoves burning gas, oil, coal, or wood. Manufacturers were allowed to produce and sell new units for cooking and heating stoves after September 1, provided that the materials used were already in stock or were acquired by authority of the War Production Board.

By order of the Securities and Exchange Commission, five subsidiaries operating in the Appalachian region were separated from the Standard Oil Co. (New Jersey), and formed into the Consolidated Natural Gas Co. The new company is one of the largest single operating units in the natural-gas industry.

GROSS PRODUCTION

The estimate of gross production of natural gas from gas and oil fields in 1942 indicates a 9-percent increase over 1941 to 4,453,900 million cubic feet. Gains in Texas represented 50 percent of the total increase for all producing States. The only substantial decline was in Illinois, where production of gas in the oil fields reached a peak in 1940.

The output of gas wells in 1942—2,875,090 million cubic feet—exceeded the revised 1941 record by 15 percent. Since 1938 the rise in gas-well production has been very rapid, stimulated chiefly by progressively greater demands from gas pipe-line systems and by the sharp uptrend in cycle-plant operations in Texas and to a lesser degree in Louisiana. The estimated production of gas from oil wells in 1942 was 1,578,810 million cubic feet—2 percent less than the revised 1941 total. Since 1938 the increase in this type of production has been small; larger output in some States, notably Louisiana and Texas, have been partly offset by reductions in others. As a result of these changes, the ratio of gas-well production to the total has increased from 51 percent in 1938 to almost 65 percent in 1942.

Repressuring and pressure-maintenance operations continued their expansion of recent years. The return of gas for these purposes to reservoirs was reported in 16 States in 1942, and the total volume increased 17 percent over 1941 to 755,971 million cubic feet. Although the magnitude of cycle operations in Texas and Louisiana tends to dominate the statistics, steady growth in repressuring is widespread in other producing areas and significant of improving methods in oil production.

The reported quantity of gas stored in natural reservoirs increased 9 percent in 1942 to a new record of 17,672 million cubic feet. Moderate increases were reported in six States, and Arkansas was added to the list of States reporting gas storage.

In September 1943 the quantity of natural gas in storage in the Appalachian region reached a peak of over 63 billion cubic feet, *Gross production and disposition of natural gas in the United States, 1941–42, by States, in millions of cubic feet*

State	Estimated production [1]			Estimated disposition			
	From gas wells	From oil wells	Total	Marketed production	Repressuring	Stored in ground	Losses and waste [2]
1941							
Arkansas	10,200	34,800	45,000	19,148	781	----------	25,071
California	36,500	423,500	460,000	374,905	21,000	6,000	58,095
Colorado	3,100	200	3,300	3,256	----------	----------	44
Illinois	900	101,500	102,400	10,053	1,958	539	89,850
Indiana	1,400	2,100	3,500	1,522	----------	----------	1,978
Kansas	77,000	46,000	123,000	111,121	2,345	597	8,937
Kentucky	71,000	5,200	76,200	69,067	480	[3] 440	5,371
Louisiana	375,100	199,700	574,800	403,855	56,008	----------	114,937
Michigan	11,900	3,200	15,100	13,916	741	72	371
Mississippi	4,450	590	5,040	4,268	----------	----------	772
Missouri	200	10	210	196	----------	----------	14
Montana	27,000	1,500	28,500	28,499	----------	----------	1
New Mexico	34,100	98,600	132,700	64,655	557	----------	67,488
New York	12,400	100	12,500	10,456	14	[3] 340	1,696
Ohio	47,500	3,700	51,200	41,858	3,213	[3] 3,166	5,167
Oklahoma	99,100	176,300	275,400	234,054	11,420	1,677	28,249
Pennsylvania	99,300	5,700	105,000	92,819	921	[3] 2,841	9,961
Texas	[4] 1,337,000	[4] 480,000	1,817,000	1,086,312	527,159	----------	203,529
West Virginia	212,100	11,200	223,300	207,681	4,722	[3] 579	7,358
Wyoming	24,600	19,000	43,600	29,284	13,010	----------	1,306
Other States [5]	5,740	10	5,750	5,733	----------	----------	17
	[4] 2,490,590	[4] 1,612,910	4,103,500	2,812,658	644,379	16,251	630,212
1942							
Arkansas	9,000	40,000	49,000	19,456	7,943	489	21,112
California	104,900	367,700	472,600	403,968	42,162	6,827	19,643
Colorado	4,700	400	5,100	4,865	----------	----------	235
Illinois	1,500	85,000	86,500	14,484	2,258	1,038	68,720
Indiana	1,200	2,490	3,690	1,599	219	----------	1,872
Kansas	77,000	48,000	125,000	112,921	3,749	[3] 1,596	7,558
Kentucky	78,000	9,700	87,700	80,089	559	----------	5,851
Louisiana	463,700	205,400	669,100	447,686	79,921	----------	141,493
Michigan	13,400	4,500	17,900	15,521	2,034	47	298
Mississippi	1,500	2,300	3,800	2,082	----------	----------	1,718
Missouri	100	10	110	100	----------	----------	10
Montana	29,900	1,600	31,500	31,475	10	----------	15
New Mexico	37,900	116,900	154,800	78,164	1,288	----------	75,348
New York	10,700	100	10,800	8,718	----------	[3] 1,057	1,792
Ohio	49,100	5,400	54,500	45,055	3,324	[3] 2,732	5,227
Oklahoma	135,600	167,000	302,600	269,704	13,457	25	18,984
Pennsylvania	99,400	5,500	104,900	93,532	997	[3] 3,064	8,192
Texas	1,508,800	482,100	1,990,900	1,170,345	580,555	----------	239,606
West Virginia	219,500	12,000	231,500	215,193	5,005	[3] 807	8,216
Wyoming	23,800	22,700	46,500	33,124	12,490	----------	886
Other States [5]	5,390	10	5,400	5,394	----------	----------	6
	2,875,090	1,578,810	4,453,900	3,053,475	755,971	17,672	626,782

[1] Marketed production plus quantities used in repressuring, stored in ground, lost, and wasted (see footnote 2).

[2] Includes gas (mostly residue gas) blown to the air and transportation losses, but does not include direct waste on producing properties, except where data are available.

[3] Includes gas transported from other States.

[4] Revised figures.

[5] North Dakota, South Dakota, Tennessee, Utah, and Virginia.

according to the Office of War Utilities, exclusive of the "gas cushion" which in operating practice is allowed to remain in the reservoirs as unavailable for distribution. Storage operations in this region in 1943 included the injection of over 22 billion cubic feet of gas in the May-September period and the withdrawal of 20.3 billion to meet the heavy demand during the cold months. In all, 44 fields are equipped as storage points for use in this program. To replenish stored supplies, many gas wells which were formerly shut in during the summer months are now producing throughout the year. It is generally conceded that gas storage has played a vital part in supplying the gas needs of war industries and others in this territory during the past two critical winters.

In other parts of the country storage of natural gas is not extensively used to meet peak-load requirements, except in Kansas. However, a few scattered fields in other States are utilized for this purpose.

The estimates of losses and waste in 1942, based upon available evidence, indicate a slight decline in the total to 626,782 million cubic feet from 1941. Material reductions are shown in Illinois and Oklahoma, conforming to declining trends in gas production from oil fields, and in California, where 21 billion cubic feet more gas were returned to oil sands for repressuring in 1942 than in 1941, with a comparable saving of gas formerly blown to the air. Compensating increases in losses and waste are indicated in Louisiana, New Mexico, and Texas. In March 1944 the Railroad Commission of Texas estimated that about 1 billion cubic feet of gas per day were being wasted to the atmosphere in Texas by being blown or flared.

MARKETED PRODUCTION

Increasing war activities caused a marked expansion in demand for natural gas during 1942. Marketed production increased 9 percent over the 1941 record in spite of shortages in manpower and equipment. Most of the producing States reported increased output, notable exceptions being New York with a 17-percent and Mississippi with a 51-percent decline. Available reserves are being rapidly depleted in these two States. Major producing States showing material gains in 1942 over 1941 were: New Mexico (21 percent); Kentucky (16 percent); Oklahoma (15 percent); Louisiana (11 percent); and Texas, California, and Ohio (8 percent each). Texas, Louisiana, California, Oklahoma, and West Virginia, in order of production, maintained the same rank as in 1941.

Natural gas produced in the United States and delivered to consumers, 1938–42 by States, in millions of cubic feet

Year	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	Mississippi	Montana	New Mexico
1938	11, 301	315, 168	1, 904	1, 169	1, 299	75. 203	46, 163	283, 899	10, 165	13, 656	21. 216	50, 706
1939	10, 107	348, 361	2, 015	2, 746	791	80, 556	47, 771	294, 370	10, 726	14, 527	23, 178	60, 284
1940	14, 379	351, 950	2, 533	8, 359	1, 137	90, 003	53, 056	343, 191	12, 648	6, 365	26, 231	63, 990
1941	19, 148	374, 905	8, 256	10, 053	1, 522	111, 121	69, 067	403, 855	13, 916	4, 268	28, 499	64, 655
1942	19, 456	403, 968	4, 865	14, 484	1, 599	112, 921	80, 089	447, 686	15, 521	2, 082	31, 476	78, 164

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Other States	Total	Value at points of consumption	
										Total (thousands of dollars)	Average per M cubic feet (cents)
1938	39, 402	35, 257	263, 164	76, 547	882, 473	134, 342	26, 678	5, 850	2, 295, 562	500, 698	21. 8
1939	29, 222	36, 469	250, 875	93, 882	979, 427	159, 226	26, 614	5, 609	2, 476, 756	534, 240	21. 6
1940	12, 187	40, 639	257, 626	90, 725	1, 063, 538	188, 751	27, 346	5, 568	2, 660, 222	577, 939	21. 7
1941	10, 456	41, 858	234, 054	92, 819	1, 086, 312	207, 681	29, 284	5, 929	2, 812, 658	621, 333	22. 1
1942	8, 718	45, 055	269, 704	93, 532	1, 170, 345	215, 193	33, 124	5, 494	3, 053, 475	692, 737	22. 7

States furnishing the largest proportion of their gas to consumers outside of their borders were: West Virginia, with 66 percent of production shipped out; Louisiana, with 46 percent; and Texas, with 25 percent. These three States furnished 60 percent of the total output of the United States in both 1942 and 1941.

The average value of gas at the wells was 5.1 cents in 1942 compared with 4.9 cents in 1941 and was the highest since 1937, when the same figure was recorded. It is probable that 1940 was an important turning point in the long-term trend in the wellhead price of gas. In that year a decline of many years' duration culminated in a low of 4.5 cents per thousand cubic feet. Changing field conditions suggest firmer price tendencies for the future. The average value at points of consumption was 22.7 cents in 1942 compared with 22.1 cents in 1941.

Natural gas produced and consumed in the United States in 1942, by States

State	Produced and delivered to consumers, including deliveries in other States						Consumed, including receipts from other States			
	Quantity		Estimated value at wells		Value at points of consumption		Quantity		Value at points of consumption	
	M cubic feet	Percent of total	Total	Average per M cubic feet	Total	Average per M cubic feet	M cubic feet	Percent of total	Total	Average per M cubic feet
				Cents		*Cents*				*Cents*
Ala							36,287,000	1.2	$8,332,000	23.0
Ariz							24,783,000	.8	7,170,000	28.9
Ark	19,456,000	0.6	$420,000	2.2	$3,027,000	15.6	54,069,000	1.8	8,961,000	16.6
Calif	403,968,000	13.2	26,662,000	6.6	110,004,000	27.2	403,968,000	13.3	110,004,000	27.2
Colo	4,865,000	.2	173,000	3.6	1,066,000	21.9	28,860,000	.9	9,984,000	34.6
D. C							5,966,000	.2	4,093,000	68.6
Fla							3,303,000	.1	786,000	23.8
Ga							31,996,000	1.1	10,666,000	33.3
Ill	14,484,000	.5	532,000	3.7	2,351,000	16.2	110,941,000	3.6	47,882,000	43.2
Ind	1,599,000	(1)	175,000	10.9	888,000	55.5	37,642,000	1.2	13,960,000	37.1
Iowa							29,481,000	1.0	10,566,000	35.8
Kans	112,921,000	3.7	5,172,000	4.6	38,354,000	34.0	121,354,000	4.0	25,139,000	20.7
Ky	80,089,000	2.6	10,804,000	13.5	33,837,000	42.2	21,382,000	.7	9,331,000	43.6
La	447,686,000	14.7	14,326,000	3.2	79,096,000	17.7	253,894,000	8.3	27,109,000	10.7
Md							7,438,000	.2	2,882,000	38.7
Mich	15,521,000	.5	2,237,000	14.4	11,044,000	71.2	42,202,000	1.4	34,849,000	82.6
Minn							29,116,000	1.0	11,232,000	38.6
Miss	2,082,000	.1	70,000	3.4	557,000	26.8	26,444,000	.9	7,272,000	27.5
Mo	100,000	(1)	12,300	12.3	52,000	52.0	61,354,000	2.0	24,263,000	39.5
Mont	31,475,000	1.0	1,467,000	4.7	8,293,000	26.3	27,773,000	.9	6,745,000	24.3
Nebr							20,730,000	.7	8,034,000	38.8
N. Mex	[2] 78,164,000	2.6	1,204,000	1.5	13,167,000	16.8	45,822,000	1.5	5,201,000	11.4
N. Y	[3] 8,718,000	.3	2,135,000	24.5	6,498,000	74.5	27,150,000	.9	20,081,000	74.0
N. Dak	122,000	(1)	4,000	3.3	40,000	32.8	1,904,000	.1	736,000	38.7
Ohio	45,055,000	1.5	7,394,000	16.4	23,715,000	52.6	144,325,000	4.7	76,085,000	52.7
Okla	269,704,000	8.8	7,741,000	2.9	38,270,000	14.2	220,991,000	7.3	24,260,000	11.0
Pa	[4] 93,532,000	3.1	20,858,000	22.3	44,783,000	47.9	143,187,000	4.7	60,200,000	42.0
S. Dak	7,000	(1)	300	4.3	2,000	28.6	7,611,000	.3	2,497,000	32.8
Tenn	10,000	(1)	1,000	10.0	4,000	40.0	22,806,000	.7	6,914,000	30.3
Tex	[5] 1,170,345,000	38.3	25,396,000	2.2	182,660,000	15.6	917,657,000	30.1	74,206,000	8.1
Utah	5,163,000	.2	176,000	3.4	1,079,000	20.9	18,920,000	.6	3,982,000	21.0
Va	92,000	(1)	9,400	10.2	86,000	93.5	1,418,000	(1)	1,283,000	90.5
W. Va	215,193,000	7.0	26,167,000	12.2	87,357,000	40.6	93,365,000	3.1	22,978,00	24.6
Wyo	33,124,000	1.1	1,100,000	3.3	6,507,000	19.6	20,634,000	.7	3,484,000	16.9
Total:										
1942	3,053,475,000	100.0	154,236,000	5.1	692,737,000	22.7	3,044,773,000	100.0	691,167,000	22.7
1941	2,812,658,000	100.0	138,508,000	4.9	621,333,000	22.1	2,805,192,000	100.0	620,038,000	22.1

[1] Less than 0.05 percent.
[2] Includes 1,182,000 M cubic feet piped to Mexico.
[3] Includes 34,000 M cubic feet piped to Canada.
[4] Includes 96,000 M cubic feet piped to Canada.
[5] Includes 7,390,000 M cubic feet piped to Mexico.

WELLS

Reported gas-well completions in 1943 (2,290) were 12 percent below 1942 and 21 percent below the 1941 peak of 2,911. Drilling for gas has declined since 1941 in nearly all States, under the influence of spacing regulations and restricted supplies and manpower. Exceptions are Pennsylvania, where the need for gas has been urgent, and California, where dry-gas development is growing in importance. In West Virginia the rapid decline in drilling in the deep Charleston gas field has obscured increased activity in smaller fields.

The number of producing gas wells in the United States increased from 55,500 at the end of 1941 to 56,150 on December 31, 1942. The net gain of 650 wells subtracted from 2,597 completions during 1942 indicates the abandonment or shutting-in of 1947 wells in that year. To the extent that old wells may have been returned to production in 1942, the actual number of wells that ceased to produce may have been larger.

Gas wells in the United States, 1941–43, by States

State	Producing Dec. 31, 1941	Drilled during 1942 [1]	Producing Dec. 31, 1942	Drilled during 1943 [1]
Arkansas	200	7	200	3
California	110	25	130	38
Colorado	20	1	20	1
Illinois	90	14	80	12
Indiana	950	21	940	19
Kansas	2,090	88	1,950	43
Kentucky	[2] 2,570	210	[2] 2,650	210
Louisiana	1,640	88	1,730	72
Michigan	450	74	520	47
Mississippi	20	1	20	--------
Missouri	130	7	120	5
Montana	450	69	460	51
New Mexico	110	15	120	8
New York	2,030	26	2,000	10
Ohio	6,700	471	6,750	455
Oklahoma	2,400	102	2,250	112
Pennsylvania	18,300	595	18,500	583
Tennessee	(2)	--------	(2)	--------
Texas	3,400	238	3,460	140
West Virginia	13,700	536	14,100	475
Wyoming	110	6	120	5
Other States [3]	30	3	30	1
	55,500	2,597	56,150	2,290

[1] From Oil and Gas Journal and State sources.
[2] Tennessee included with Kentucky.
[3] North Dakota, South Dakota, Utah, and Virginia.

TECHNOLOGIC DEVELOPMENTS

Many materials can be made from natural gas by cracking it into its various hydrocarbons and bringing them together in different combinations. Continued experiment and research by chemists in 1943 resulted in the discovery of new products, new uses for those previously found, and improved methods of production.

Carbon black, valuable in the production of synthetic rubber products, was produced in large quantities as a byproduct of the pyrolytic cracking of natural gas to produce hydrogen.

A plastic called polythene, which can be made from coal and petroleum, was also made from natural gas. It has properties that fit it for varied uses. In thin sheets it is flexible enough for toothpaste tubes, waterproof coatings, and wire insulation. In thick sheets it is stiff enough to be used as a rigid plastic. Other plastics that can be substituted for strategic materials and to supply nondefense industries have also been developed from natural gas.

Several large plants are using natural gas as fuel in the production of magnesium, a light metal now extensively used in building airplanes and the production of ordnance materials.

When gas hydrocarbons are liquefied, valuable materials, such as benzine, toluene, and the heavier aromatic products may be obtained. These were formerly produced only by carbonizing coal. Improved techniques of extracting and treating liquids from natural gas indicate that the production of liquid motor fuel from methane may become economically feasible under favorable conditions before many years.

The use of natural gas as a fuel for dehydrating foods continued to increase rapidly under the influence of war. The armed forces have demanded vast quantitites of dehydrated foods in wide variety for shipment overseas, chiefly because they permit a great saving in shipping space over fresh or canned products.

New or expanded applications of gas by metalworking industries have been numerous and have often speeded the production of war goods. Among these were larger and more complex radiant tube furnaces and the use of controlled atmospheres containing fuel gas to eliminate oxide formation on steel, to carburize steel surfaces, and to "pickle" steel sheets for better adherence of zinc and other coatings. A process of heat-treating metal shapes by impact of a gas flame was developed to reduce greatly the time required over conventional furnace methods.

POST-WAR PLANS

Progressive members of the natural-gas industry are planning post-war activities, even when meeting present war emergencies. Studies are being made to determine the effects of national trends upon gas markets in different sections of the country and the most efficient means of distributing and utilizing gas. Methods of stimulating sales are being considered and coordinated with the results of detailed analyses of gas markets, rates, distribution costs, and competitive influences. Greater emphasis upon advertising is anticipated, particularly of the type directed at specific groups of potential consumers.

Many innovations are being introduced in new designs for appliances and equipment which will include the use of new plastics and other substitute materials. Closer relations between the utilities and gas-appliance manufacturers may result in more efficient home appliances.

Gas air-conditioning units suitable for homes and small business establishments have been developed in readiness for manufacture and sale when industry resumes peacetime activities. The cost per unit is too high to attract a broad market, but demand may be sufficient to facilitate substantial cost reductions as the volume of production grows.

The post-war future of the two large Government-owned pipe lines that now transport crude oil and petroleum products from Texas to the eastern seaboard has been the subject of much speculation within the oil and gas industries. It has been proposed that one or both lines be converted to natural-gas service after the emergency.

REVIEW OF FIELD DEVELOPMENTS, BY STATES

Arkansas.—There were 3 gas completions in northwest Arkansas in 1943 compared with 1 in 1942. Two wells were drilled in Franklin County, with initial productions of 35 and 33 million cubic feet, respectively, at depths of 1,345 and 1,380 feet. One well in Johnson County was completed at 3,260 feet for an initial production of 1 million cubic feet. Five other tests in the northwest area were dry. The 21 dry-gas fields in the region averaged about 15 million cubic feet daily production during the year.

One gas well was completed in southern Arkansas in Union County at a depth of 3,564 feet. It produced 25 million cubic feet initially. The southern oil and gas fields produced about 111 million cubic feet of gas a day during 1943, a substantial increase over 1942. A plant for removing the hydrogen sulfide from sour gas is operating in the McKamie field. It is estimated that about 25 million cubic feet of sweet gas are being converted daily from 30 million cubic feet of sour gas. A second plant 7 miles southwest of Magnolia will convert the sour gas from the Dorcheat and Macedonia fields into commercial fuel, partly for use in war plants.

Production in Arkansas increased 54 percent from 29,560 million cubic feet in 1942 to 45,640 million in 1943. The southern counties supplied 88 percent and the northwest area 12 percent of the total. Production from the gas fields decreased 2 percent from the 1942 output of 5,367 million cubic feet to 5,259 million, whereas output from the oil fields increased 67 percent from 24,193 million cubic feet to 40,381. Columbia County, with 25,250 million cubic feet, more than doubled the 1942 record and displaced Union County as the largest source of gas. Johnson County, with 2,388 million cubic feet, ranked first in the northwest area; and Pope County, with 1,064 million, displaced Crawford in second place.

Information relative to natural-gas developments in Arkansas during 1943 was supplied by Joe W. Kimzey, State geologist, from records of the Arkansas State Department of Revenues.

California.—The following information was taken from a report from E. F. McNaughton, California Railroad Commission:

Because of insufficient supplies of oil in California following unusually heavy requirements during 1943, both high- and low-gravity fields were drilled in search for new supplies, and drilling for gas had secondary importance. There were no major discoveries, but some small fields were added to gas production.

A well was completed in the Hamilton zone of the Rio Vista dry-gas field, but little was added to the meager information available about the formation. Three relatively shallow dry-gas zones were found in the El Segundo field in the Los Angeles Basin at a depth of 2,200 to 4,300 feet. Dry gas was discovered in areas near Mendota and Firebaugh, Fresno County, and small areas were opened in Butte and Glenn Counties. A new well in the Buttes area helped the failing output there. Two dry-gas wells near Willow were tapped to supply that community.

Declining production from the Marysville Buttes and the Rio Vista dry-gas fields caused utilities serving northern and central California to make new pipe-line connections, to reinforce lines to carry higher pressures, and to make shifts in their transportation systems so that auxiliary supplies could be obtained from other sources.

Equipment was installed in several gasoline plants in southern California to eliminate waste and to increase line pressures so that the residue gas could be delivered direct to transmission lines serving the Los Angeles and Santa Maria areas and to the Goleta storage project and thus, by substitution, make more gas available in other areas for consumption or for storing.

Underground storage in the Playa del Rey field, which was begun in 1942, was continued in 1943. At the close of the year, 1,731 million cubic feet of gas had been injected into the field and about 121 million withdrawn. There is some indication that all the gas injected will not be recoverable, but this cannot be determined until injections and withdrawals have been checked over a longer period than is possible at present.

A study of peak-day demands estimated under minimum temperature conditions in both northern and southern California was made by the commission to determine whether the gas supply in the State was adequate. It was concluded that an estimated firm, noncurtailable demand of 1,258 million cubic feet could be met by natural-gas distributors, with the help of stand-by manufactured-gas plants. The total potential peak-day demand was estimated at 1,890 million cubic feet in 1943 compared with 1,635 in 1942. Natural gas reserves in California are estimated at a revised figure of 11,927,774 million cubic feet.

No figures of production are available for the full year 1943, but comparison of records for the first 6 months of 1942 and 1943 shows a 13-percent increase. Dry-gas production continued to increase, and a 47-percent gain over the 1942 record is indicated by available figures. Withdrawals from the Rio Vista dry-gas field supplied 83.8 percent of the total dry gas produced in California in 1943. Repressuring was continued during the year, stimulated by the emphasis placed upon conserving liquid petroleum products. Withdrawals from fields having high gas: oil ratios continued to be restricted, except during emergency periods. Efforts are being made to reduce the volume of gas wasted. A purification plant with a daily capacity of about 30 million cubic feet is being installed in the Coalinga field, where 30 to 50 million cubic feet of gas have been blown to the air monthly because its hydrogen sulfide content rendered it unfit for market.

Gas sales in California totaled 303,621 million cubic feet in 1943—a 15-percent gain over the 1942 record. The number of gas customers increased 3 percent over the 1942 figure to 2,034,930. When gas supplies failed to meet peak loads during the winter of 1943, a large number of industrial plants had their deliveries curtailed in favor of firm and war-production customers. More plants in southern California were affected by the shortage than in any previous period. The use of gas as fuel in electric generating plants was increased materially during the year to conserve petroleum.

Colorado.—Ernest A. Hanson, supervisor, Geological Survey, United States Department of the Interior, Casper, Wyo., reports only one gas completion in Colorado in 1943. This was an exploratory well at Douglas Creek, Rio Blanco County, which had been drilled to the Weber quartzite at a depth of 8,558 feet in 1942 in an unsuccessful search for oil. A gas well was developed in 1943 by plugging back the hole and perforating opposite three sands in the Dakota and Lakota formations at a depth of 4,326 to 4,430 feet. The initial production of the completed well was 5,800,000 cubic feet per day and the shut-in pressure 1,680 pounds. It will not be used until the proved gas reserves of northwestern Colorado justify the building of a pipe line to a profitable market.

The Hiawatha and Powder Wash fields, whose output increased 38 and 39 percent, respectively, over 1942, furnished 96 percent of the marketed production in Colorado during 1943. Production by fields, in millions of cubic feet, follows: Hiawatha, 3,714; Powder Wash, 1,527; Thornburg, 171; Berthoud, 43; and Craig 5.

Gross output in Colorado in 1943 was 6,148 mllion cubic feet—40 percent over the 1942 record of 4,387 million. It is estimated that 273 million cubic feet were used for repressuring or were recycled. Field use was reported as 175 million cubic feet for the year compared with 54 million in 1942. Estimated losses have declined 21 percent from 304 million cubic feet in 1942 to 240 million in 1943. There is still surplus gas in the Wilson oil field, where the gas: oil ratio averaged 368 cubic feet of gas to 1 barrel of oil.

Marketed production totaled 5,460 million cubic feet, 35 percent over the 4,030 million reported in 1942.

Illinois.—Natural-gas developments in Illinois during 1943 were reported by A. H. Bell, geologist, and C. W. Carter, assistant geologist, Illinois Geological Survey.

Five wells, all producing from the Bridgeport sand, were drilled in the Russellville gas field during the year, making a total of 59 in that area. The initial production of the new wells averaged 3 million cubic feet of gas a day. At the end of the year, 1,650 acres of the Buchanan and 270 acres of the Bridgeport sand were proved by drilling.

The Ayers field in Bond County, with one gas completion in 1943, had nine producing wells altogether. Gas comes from the Bethel sandstone at an average depth of 950 feet.

A major part of the casinghead gas from the oil fields is treated for natural gasoline, but as yet only a small percentage of the residue gas is used. The Louden field had an average daily production of 15 million cubic feet in 1943, most of which was processed for gasoline. The output in 1942 averaged 20 million cubic feet a day. A pipe-line company distributed part of the residue gas at the rate of 1.4 million cubic feet a day in 1943 and 1.9 million in 1942. The same company also took 90 thousand cubic feet a day in 1943 and 50 thousand in 1942 from a well in the field which produces from a basal Pennsylvanian sandstone. The total production of the field was 7 billion cubic feet in 1943 compared with 8.4 billion in 1942.

Production from the Salem field is estimated at 20 billion cubic feet and averaged 37 million cubic feet a day at the end of the year compared with 23.7 billion produced in 1942 and a daily average of 63 million at the end of the year. Three gasoline plants processed approximately 35 million cubic feet daily in 1943, 6 million of the residue being used for repressuring and 1 million being distributed to nearby towns. In 1942, 49.8 million cubic feet were processed daily, 5 million of the residue being used for repressuring and 0.8 million being distributed.

In the Dale-Hoodville Consolidated field of Hamilton County, 6.2 billion cubic feet of gas were processed from a total output of 7 billion cubic feet. Only 51 million cubic feet of the residue gas were used for repressuring, the remainder being flared.

In the Benton field of Franklin County, 320 million cubic feet of a total 3 billion produced were processed for gasoline. There were no repressuring operations in that area, and no residue gas was sold.

Eight billion cubic feet were produced in the New Harmony Consolidated field of White County, of which 4.9 billion were processed. Only 1.8 billion cubic feet of residue gas were returned to the producing sands. None was sold. Production in 1942 totaled 8.7 billion cubic feet.

Approximately 62 billion cubic feet of gas were produced in Illinois during 1943 from fields discovered after January 1, 1939, compared with 84.4 billion in 1942. A large part of the output was burned in flares. Marketed production in the State totaled 2,410 million cubic feet—a 6 percent decrease from the 1942 figure. Output by fields, in millions of cubic feet, was: Russellville 1,236, Ayers 14, Salem 650, and Louden 510. Forty-eight percent of the total amount was casinghead gas from the oil fields.

Indiana.—There were no new gas developments of importance in Indiana during 1943, according to Ralph E. Esarey, State geologist, and P. Hastings Keller, assistant State geologist, Indiana Department of Conservation.

Only 19 gas wells were drilled in the State during the year, and all were in the old Trenton area; 21 were drilled in 1942 and 56 in 1941. The total initial production of the new wells (2,562,000 cubic feet) was 77 percent less than that of the completions in 1942 (11,148,500 cubic feet).

Figures on natural-gas production in Indiana are not complete for 1943. The output of the three largest gas fields, in order of rank, was as follows: Rockport in Spencer County, 500,151,000 cubic feet; Greensburg in Decatur County, 228,894,100; and Unionville in Monroe County, 168,710,000. These figures indicate a 14-percent decline from the 1942 output.

A total of 1,700,923,000 cubic feet of casinghead gas from the Griffin field was processed at a natural-gasoline plant on the Illinois side of the Wabash River. This gas probably was returned to the producing sands in the field for repressuring.

Kansas.—Phillip Kaiser, geologist, Kansas Geological Survey, reports 43 gas wells and 12 combination gas and oil wells drilled in Kansas in 1943. This compared with 88 completions in 1942.

The number of gas and combination wells drilled in western Kansas pools was: Zenith-Peace Creek, four; Chitwood, and Medicine Lodge, three each; Burrton, two and Belpre, Canton North, Deerhead, Farmington, Kipp, Kraft-Prusa, and Vernon North, one each. Gas completions in eastern Kansas pools, were: Wyandotte County, five; Allen, Cowley, and Douglas, two each; and Leavenworth (exclusive of McLouth), one.

Ten gas wells were completed in the Hugoton field of Kansas during the year—6 in Kearny County and 4 in Stevens County—compared with 21 in 1942. The combined daily capacity of the new wells was 199.6 million cubic feet. The field had a total of 336 commercial gas wells, with a combined open flow of about 4.2 billion cubic feet at the end of 1943, and had supplied 350 billion cubic feet of gas since its discovery in 1922. It is estimated that 1,500,000 acres have been proved, but at present withdrawals are from only 217,600 acres. The producing formation—three to five zones of porous limestone and dolomite of the Chase group (Permian)—lies at an average depth of 2,750 feet.

Ten gas wells were drilled in the McLouth field during the year compared with 44 in 1942. Being close to the industrial centers of northeastern Kansas, this pool has had its reserves heavily drawn upon. The proved area was extended during the year by a well 2 miles east of previous production, which opened the Jarbalo pool in Leavenworth County. The initial daily potential of the well was 10 million cubic feet. Two more gas wells were drilled in this pool by the end of 1943. The producing sand is in the lower Cherokee shale (Pennsylvanian), at an average depth of about 1,250 feet.

Three wells, two producing both gas and oil, were completed in the Cunningham-Cairo field in 1943 compared with four in 1942.

Another gas pool, the Chegwidden, was discovered in Russell County, western Kansas, by a completion having an initial daily potential of 10 million cubic feet.

The Conservation Division of the Kansas Corporation Commission reports 122 billion cubic feet of natural gas produced in Kansas in 1943, 18 percent over the 103 billion reported in 1942.

Production by major fields, in billions of cubic feet, follows: Hugoton, 63.4; Medicine Lodge, 13.7; Otis, 13.3; Cunningham, 9.4; Burrton, 6.4; McLouth, 2.6; and Alden, 2.1. The output of the Hugoton field increased 53 percent over that of 1942 and was over half of the State total. The McLouth pool produced only about half as much as in 1942. Production in eastern Kansas is estimated at 6.5 billion cubic feet in 1943.

Kentucky.—Mrs. Louise B. Freeman, assistant State geologist, Department of Mines and Minerals, has reported natural-gas developments in Kentucky in 1943.

There were 210 gas wells drilled in 17 counties during the year, the same number as was reported drilled in 9 counties in 1942. Two wells completed in Knox County were some distance southeast of proved territory and increased the known reserves of that area. The remainder were in previously discovered gas fields. Completions in the most active counties were: Pike 75, Knott 31, Floyd 27, Martin 27, Johnson 8, and Jackson 7. These counties ranked the same as in 1942, except that Knott and Floyd changed places, and Johnson displaced Clay and Jackson in fifth place. Gas developments in western Kentucky continued to be negligible.

The only new source of marketed gas was the Jackson County field, which has been developed since 1934 but never used. The first pipe-line connection was made in November 1943.

Producing formations in the Big Sandy gas field of Johnson, Magoffin, Morgan, Breathitt, Clay, and Knox Counties, eastern Kentucky, and the percentage of total wells, including dry holes, drilled to each, exclusive of the Wier and Corniferous production, are as follows: Black Shale (Chattanooga) 62 percent; Maxon Sand (Mauch Chunk) 11; "Salt Sand" (Pennsylvanian) 7; "Big Lime" (Mississippian) 7; and miscellaneous (including Big Six, Big Injun, and Berea) 3. Of the total wells drilled in the Big Sandy field, 11 percent have been dry holes.

Natural gas has been stored underground in Kentucky since 1918. A gas field in Menifee County was first used for that purpose and is still maintained as a reserve, although at present it is not often drawn upon. Another field in Meade County is used to store a reserve supply for Louisville during periods of peak demand. The structure of both fields is such that there is little danger of leakage.

Waste of gas with the production of oil was small in western Kentucky and has been practically eliminated in eastern Kentucky.

Figures of gas production for 1943 were not reported.

Louisiana.—The major part of the drilling in Louisiana in 1943 was in search of crude-oil production, and many of the gas wells drilled were a disappointment from the point of view of the producers. Eleven new fields producing gas or gas distillate were added to producing areas in the State during the year. Of these, six were in the southern area. New gas distillate fields were opened in Beauregard, St. James, and St. Landry Parishes, and a new gas area was opened by a well with an estimated open flow of 45 million cubic feet in northern Louisiana, northwest of Ruston, Lincoln Parish. Five parishes in Louisiana now produce gas only, and 33 produce gas and oil.

In all, 85 gas wells were reported as drilled in Louisiana in 1943, 66 in the northern and 19 in the southern part of the State.

H. W. Bell, director, Louisiana Division of Minerals, has supplied the following information:

Total natural-gas production in Louisiana in 1943 was 699,082 million cubic feet, of which 515,010 million (74 percent) were produced from gas wells and 184,072 million (26 percent) from oil wells. In 1942 total production was 669,136 million cubic feet, of which 463,695 million (69 percent) were from gas wells and 205,441 million (31 percent) from oil wells. These figures show a gain of 4 percent in the total output, an 11-percent gain in the volume of gas produced from gas wells, and a 10-percent loss in the volume produced from oil wells.

Of the gross total in 1943, 91,144 million cubic feet were returned to the producing sands, and 97,617 million were flared or vented to the air, leaving 510,321 million to be marketed or used.

Michigan.—Seven gas fields were discovered in Michigan, and one old field was extended during 1943, according to a report submitted by F. R. Frye, petroleum engineer, Michigan Department of Conservation.

The Cranberry Lake field in Clare and Missaukee Counties had 21 wells drilled and 3,360 acres proved. The Woodville field in Newaygo County had over 800 acres proved by five new wells. The other discoveries were in Gratiot, Mecosta, Montcalm, and Osceola Counties. A discovery well with an initial production of 10,400,000 cubic feet of gas was drilled in the Goodwell field in Newaygo County. It was finally deepened and completed as an oil well. In four of the new fields no wells in addition to the discovery had been completed at the end of the year.

Only 47 gas completions, all in the Michigan Stray sand, were reported in 1943 compared with 74 in 1942. More than half of the new wells were in Clare and Newaygo Counties.

The Austin field in Mecosta County is being used for gas storage.

It is reported that over 4 billion cubic feet have been returned to the Michigan Stray sand, bringing the pressure back almost to the original shut-in pressure of the field.

Pipe-line construction in Michigan in 1943 was limited to connections between gas fields and distribution lines, except for a line connecting the Austin gas pool storage project with the Six Lakes field.

Natural-gas production in Michigan reached a new peak of 19,581,420,000 cubic feet in 1943, 10 percent over the 1942 figure of 17,749,249,000 cubic feet.

Mississippi.—H. M. Morse, supervisor, State Oil and Gas Board, reports that no gas wells were drilled in Mississippi during 1943.

All of the wells in the Jackson field, still the main source of gas in the State, are producing salt water with the gas. Four wells were abandoned, leaving 19 producing. Rock pressure is about 900 pounds.

A total of 18,645,000 cubic feet of casinghead gas was flared in the oil fields.

Production from the Jackson field was 1,349,936,000 cubic feet. Gross production for the State was 1,368,581,000 cubic feet.

Missouri.—According to Frank C. Greene, geologist, Missouri Geological Survey, five gas wells were drilled in Missouri in 1943 compared with seven in 1942. All of the new wells were in Jackson County, which had no completions in 1942. Their initial open flow was 760,000 cubic feet daily.

A 7-mile pipe line from the Prairie Point pool in Platte County to the industrial district of Fairfax was completed during the year.

A study was made of the Polo field, discovered in 1940, but no pipe-line connections have as yet been made.

Montana.—Data on natural-gas developments in Montana during 1943 were taken from a report by Ernest A. Hanson, supervisor, Geological Survey, United States Department of the Interior, Casper, Wyo.

There were 51 gas completions during the year, a 26-percent decline from the 1942 record. Bowdoin and Cedar Creek fields reported 40, Marias River 3, Davon and Cut Bank 2 each, and Haystack Butte, Ingomar, Kevin-Sunburst, and Whitlash 1 each. The combined open-flow capacity of the new wells was 64,640,000 cubic feet.

The wells drilled in the Marias River field extended the proved territory about 4 miles northeastward. The field was discovered in 1940, but the gas was not used commercially until December 1943, when it was turned into the pipe line that supplies Shelby. Gas is found in a 5-foot sand in the Colorado shale, at an average depth of 1,300 feet.

The discovery well drilled at Ingomar in the northwestern part of Rosebud County was reported as producing noninflammable gas from the Amsden formation at a depth of 3,800 to 4,119 feet.

Gross production in Montana in 1943 totaled 31,597 million cubic feet, 2 percent over the 31,012 million reported in 1942. Repressuring accounted for 35 million, field use for an estimated 1,038 million, and losses for an estimated 199 million, of which 150 million were in the Cut Bank field. There was a 4-percent decrease in the volume of gas treated for natural gasoline, but a 1-percent increase in the quantity of gasoline extracted. A plant in the Cut Bank field treated 11,434 million cubic feet of gas in 1943 to produce 2,737 thousand gallons of gasoline. Another plant in the Dry Creek field treated 90 million cubic feet to produce 55 thousand gallons of gasoline.

Marketed production totaled 30,325 million cubic feet, only 415 million over the 1942 record. Output decreased in all fields except Bowdoin, which increased 14 percent, and Cut Bank, which increased 12 percent. The Cut Bank field supplied 50 percent of the total output in 1943 compared with 45 percent in 1942. Marketed production, by fields, in millions of cubic feet was: Bowdoin 3,563, Bowes 454, Box Elder 482, Cedar Creek, 6,221, Cut Bank 15,205, Devon 356, Dry Creek 995, Hardin 87, Haystack Butte 68, Kevin-Sunburst 1,901, and Whitlash 993.

New Mexico.—L. G. Snow, supervisor, Geological Survey, United States Department of the Interior, Roswell, N. Mex., reports three gas wells (one in Eddy and two in Lea County) drilled in southeastern New Mexico in 1943 compared with eight in 1942. The initial production of the Eddy County well was 1,000,000 cubic feet and the combined initial output of the Lea County wells 7,130,000 cubic feet. Production in Lea County was found in the formations of upper Permian age.

Five wells (all in San Juan County) were completed in the northwestern part of the State compared with four in 1942. Three found gas in the Pictured Cliffs sand of the Fulcher Basin field and two in the Dakota sand of the Barker Creek field. Their total initial production was 9,378,000 cubic feet.

In southeast New Mexico 98,859 million cubic feet of gas were treated for natural gasoline and 47,173 million cubic feet of the residue gas were sold to domestic, commercial, and industrial consumers.

Comparable figures for 1942 are 103,704 and 44,132 million, respectively. Gas used for gas lift, field consumption, and vented without treatment for gasoline totaled 40,000 million cubic feet, a 15-percent decline from the 1942 record. There were two pressure-maintenance projects in Lea County under which 1,565 million cubic feet of residue gas were returned to oil-producing formations and recycled to gasoline plants. In Eddy County 1,027 million cubic feet were injected without being treated for natural gasoline.

Consumption by domestic, commercial, and industrial consumers in southeast New Mexico increased 59 percent from 44,207 million cubic feet in 1942 to 70,448 million in 1943.

Gas used for gas lift, field consumption, and vented without being treated for gasoline in northwestern New Mexico was only 50 million cubic feet in 1943 compared with 125 million in 1942. Domestic, commercial, and industrial consumption totaled 4,807 million cubic feet, 20 percent over the 1942 record.

Total production in Lea and Eddy Counties in 1943 was about 6 percent and in San Juan County about 17 percent above the 1942 output. The total for the State increased about 7 percent.

New York.—The prospects for finding new production in New York are discouraging, according to C. A. Hartnagel, State geologist. Only 2 producing wells, both in Tompkins County, were obtained from 26 Oriskany tests drilled during 1943 compared with 6 from the same number of tests in 1942. The combined production of wells drilled to the Oriskany sandstone, which produces most of the State output, has declined gradually since 1935. The total initial daily capacity of the 2 completions in 1943 was only 3,500,000 cubic feet. During the past 15 years over 500 Oriskany wells have been drilled in southern New York, in the following counties: Allegany 155; Steuben 214; Chemung 29; Tompkins 30, and most of the remainder in the short lived Wayne-Dundee field in Schuyler and Yates Counties.

Allegany County had six tests drilled to the Oriskany sandstone in 1943, Steuben nine, Chemung four, and Tompkins four. Four of the wells in Steuben County were over 5,000 feet deep and four in Allegany over 4,600 feet. A well in Schuyler County was drilled to 2,902 feet without finding the Oriskany.

Great interest is being shown in two tests that were being drilled at the close of the year. One is the deepening of the discovery well in the Woodhull Oriskany gas field; the other is at Arcade, Wyoming County. Both will penetrate the entire Silurian series and are expected to reach the Trenton limestone.

Underground storage of natural gas has been practiced in southern Erie County since 1918. Other storage areas now in use are in Chatauqua County, where the Medina formation serves as a reservoir, and the Oriskany gas field in Schuyler County. A deep well in Greenwood, Steuben County, and another in Wirt, Allegany County are also being used.

No production figures for New York in 1943 were reported.

North Dakota.—Commercial gas production in North Dakota comes from the small portion of the Cedar Creek field, which lies in Bowman County near the Montana boundary. Wilson M. Laird, State geologist, North Dakota Geological Survey, reports that gas has been found in other counties but is not produced in commercial quantities. No new developments were reported in 1943. Only 6 out of 14 wells were producing during the year. The gas comes from the Eagle sand of the Pierre shale at a depth of about 1,200 feet.

Production was 177,067,000 cubic feet in 1943 compared with 121,955,000 cubic feet in 1942.

Ohio.—Information relative to natural-gas developments in Ohio during 1943 has been supplied by Kenneth Cottingham, chief geologist, Ohio Fuel Gas Co.

Efforts to find production during the year were disappointing. Only 8 more completions were recorded in 1943 than in 1942, but the number of dry holes increased 35, thus reducing the number of successful wells; 11 fewer oil and 16 fewer gas wells were completed. The loss in number of gas wells was somewhat compensated by a decided improvement in the average initial production, 913 thousand cubic feet per well in 1943 compared with 668 in 1942. Wells in the Oriskany sand had the highest initial volume, averaging 1,392 thousand cubic feet per well daily. Those in the Clinton sand averaged 1,237 and those in the Newburg (next in volume) 661 thousand cubic feet. Productive sands and number of gas completions were: Clinton 276, Berea 89, Shallow 57, Oriskany 17, Ohio shale 12, and Newburg 4.

No noteworthy discoveries were made during the year. New territory was limited to about 30 small pools averaging approximately 300 acres each found in 17 counties of eastern Ohio. Most of these pools were considered discoveries rather than extensions to proved acreage, to which they were usually adjacent. Six were from the Berea sand, one from the Newburg, three from Shallow sands, and the remainder from the Clinton. There was no new development in western Ohio, where the Trenton sand predominates.

New Clinton wells proved 1,200 additional acres in Lorain County, 1,000 in Wayne and Holmes, 1,000 in Muskingum, 700 in Tuscarawas, and 700 in Stark. A number of unusually large Clinton wells were drilled in Lorain County, initial production being as high as 13, 12, and 7 million cubic feet. The largest Clinton well of the year was in Muskingum County, completed at a depth of 4,031 feet. Its initial production was 14,364 thousand cubic feet and its initial rock pressure 1,160 pounds. A well with an initial open flow of 7,500 thousand cubic feet drilled to the Clinton sand in Galia County was outstanding because it was unusually large for that area. Depth of the productive sand varied from 2,400 feet in Lorain County to 4,850 feet in Tuscarawas County. The deepest Clinton test was dry. It was drilled in Mahoning County to a depth of 6,059 feet.

The only area where Oriskany drilling predominated was in the northern part of the Cambridge field in Guernsey County, where production was found at a depth of about 3,400 feet. Fourteen gas wells and two dry holes enlarged the proved territory there by about 2,500 acres.

Drilling in the Berea sand was scattered. The most successful pool was in Meigs County, where 12 gas wells and 2 dry holes added about 1,000 acres to the proved territory. The sand in that area is about 1,650 feet deep. The initial flow of the largest well was slightly over 1 million cubic feet a day. Athens and Morgan Counties led in the number of wells drilled to the Berea formation.

The deepest well drilled in 1943 was in Meigs County. It was dry in all formations and finally abandoned at a depth of 7,466 feet.

Twenty-nine counties had gas completions in 1943 compared with 30 in 1942. Morgan County ranked first in number of completions in both years. The highest-ranking counties and the number of wells drilled were as follows: Morgan 53; Medina 38; Muskingum 35, Lorain 29; Athens 27; Holmes 26; Meigs 26; Stark 25; Ashland 22; Perry 22; Guernsey 20; and Washington 20.

No information regarding the production of natural gas in 1943 is as yet available.

Oklahoma.—There were 112 gas completions reported in Oklahoma in 1943 compared with 102 in 1942. Although about twice as many wildcat wells were completed for gas as in 1942, no notable discoveries were made during the year. These discoveries were in the following counties: Hughes, 5; Comanche, Jackson, Okfuskee, and Payne, 3 each; and Greer, McIntosh, Pawnee, Pittsburg, Sequoyah, and Stephens, 1 each.

Elmer Capshaw, gas engineer, Oklahoma Corporation Commission, has supplied the following information relative to natural-gas developments in Oklahoma during 1943. A number of small gas areas were equipped to produce by plugging back depleted oil wells to gas-bearing sands. Failing supplies and the scarcity of new sources of production resulted in more careful utilization of available output and increased efforts to reduce waste. Gas companies connected lines to a number of producing oil properties to use the casinghead gas that might otherwise have been blown to the air.

Gas reserves were drawn upon heavily in 1943, and in the Chickasha-Cement area they may be depleted in 6 or 7 years unless new gas-producing sands are discovered. It is estimated that reserves in the

Hugoton field in Oklahoma and Kansas total about 20 trillion cubic feet of gas, which, at the present rate of withdrawals, will last 30 or 40 years.

Gas was stored in small amounts in the Oklahoma City field in 1943 and in larger quantities in the Osage County field just outside of Tulsa.

Gas production in the State during the year increased about 8 percent over the 1942 record and totaled 297,771 million cubic feet. Gas wells produced 160,456 million (54 percent) and oil wells 137,315 million (46 percent). Of the 1942 total, gas wells produced 125,468 million cubic feet (45 percent) and oil wells 151,064 million (55 percent). These figures indicate a 28-percent increase in dry-gas output in 1943 and a 9-percent decrease in wet gas.

There was a tendency during the year to increase the price of gas at the wells whenever allowed by the Office of Price Administration.

Pennsylvania.—J. G. Montgomery, Jr., vice president, United Natural Gas Co., has supplied information relative to natural-gas developments in Pennsylvania during 1943. The shallow gas fields continued to supply the major part of the natural gas produced in the State during the year.

A total of 770 shallow-sand wells was drilled in 1943, of which 579 (75 percent) produced gas. The majority of these were in known gas areas. Twenty-five had initial open flows of over a million cubic feet per day. Their county locations were: Greene and Westmoreland 4 each, Fayette and Clearfield 3 each, Allegheny, Armstrong, Warren, and Washington 2 each, and Forest, Jefferson, and Clarion 1 each.

A few large-volume wells were drilled in the Armbrust pool discovered in 1941 in Westmoreland County. The area had 2,200 acres proved in 1942, but its limits are now fairly well defined by a number of unproductive tests.

No important discoveries were made during the year, although the ratio of exploratory drilling increased materially. A pool was opened in the Venango sand in Warren County; its limits have not as yet been established. Four of the completions had an average initial production of over a million cubic feet a day, with a rock pressure of only 85 pounds per square inch. A new pool in the Big Injun sand was discovered in Fayette County. Three completions had an average initial production of about 1,170,000 cubic feet a day and a rock pressure of 675 pounds per square inch.

Deep drilling met with little success in 1943. Only one of three wells drilled in what is thought to be a southern extension of the Summit pool in Fayette County found a very small flow of gas. The original discovery well in the pool was deepened and additional production found in a limestone that is probably part of the Upper Silurian series. Three deep wells were drilled to the Oriskany sand in Potter County and one in Tioga County. In Potter County one test was dry, one encountered gas with much salt water, and one was completed as a small gas well. In Tioga County a well drilled between the Sabinsville and Tioga gas pools found the Oriskany sand unproductive.

Tests drilled in McKean, Crawford, Mercer, Beaver, and Westmoreland Counties were not encouraging. A well in Mercer County encountered a small volume of gas in the Lockport dolomite and is being deepened. One well in Westmoreland County drilled to the Oriskany sand was abandoned at 9,024 feet, and a second was abandoned when the key Tully limestone was penetrated twice with a vertical separation of 753 feet. Complex formations and faulting make deep drilling in Pennsylvania difficult and unusually hazardous.

No figures are available for shallow-gas production in Pennsylvania in 1943, but it is estimated that it was close to the maximum rate. Many of the large companies are building up reserves by storing gas in old fields instead of closing in some wells in seasons of low demand, as was customary in pre-war years.

Production from the deep Potter-Tioga County field continued the decline begun in 1939. Output has fallen 93 percent from 30 billion cubic feet in 1939 to 2 billion in 1943.

South Dakota.—A deep gas test drilled to the Dakota sands in Potter County, S. Dak., just east of the Missouri River, was reported in 1943. It had a daily initial flow of 86,400 cubic feet of gas, but production was accompanied by water. Several million acres are now under lease by major oil companies in North and South Dakota.

According to Ernest A. Hanson, supervisor, Geological Survey, United States Department of the Interior, Casper, Wyo., the only production in the State in 1943 was 6.7 million cubic feet produced by the city of Pierre from a water well. The gas is used for heating city and State offices.

Tennessee.—Kendall E. Born, associate geologist, Tennessee Department of Conservation, reports that the only areas in Tennessee producing natural gas commercially in 1943 were Sunbright and vicinity in Morgan County and Jamestown in Fentress County. Approximately 12 wells also supply small volumes of gas for domestic use.

Marketed gas totaled about 18,000,000 cubic feet.

Texas.—Marketed gas production continued upward in 1943 to about 1,320 billion cubic feet, 13 percent above 1942, owing to larger output from gas and condensate wells. The major gas pipe-line systems operated at nearly maximum capacity and in some localities were unable to fully supply total market requirements for brief peak periods.

Incomplete reports indicate that gas-well completions were fewer in 1943 for the second successive year, numbering about 170 compared with 238 in 1942. In the Panhandle the decline was over 50 percent or from 63 in 1942 to 30 in 1943. In West Texas, gas completions were 11 in 1942 and only 8 in 1943. Increases in 1943 over 1942 were reported only in the Lower Gulf Coast and Southwest Texas districts.

In East Texas, condensate fields were discovered at Appleby, Nacogdoches County (Travis Peak formation), and at Stewards Mill, Freestone County (Woodbine sand). The large Carthage field, Panola County, had important extensions to the north, east, and west which establish it as one of the greatest gas reserves in the United States.

Five gas discoveries were reported in North Central Texas as follows: Eastland County one, Palo Pinto two, Shackleford one, and Stevens one. All new gas production was from the Caddo, Strawn, and Marble Falls formations of Pennsylvanian age.

In the Upper Gulf Coast, three dry-gas and several condensate fields were opened. The dry-gas discoveries were Citrus Grove in Matagorda County, which is probably a large field, the Menefee and North Louise fields in Wharton County. Among the condensate discoveries were Chesterville, Colorado County, and Jackson Pasture, Chambers County. An important new condensate sand was found in the Katy field in Waller County.

Gas discoveries were made in McMullen and Starr Counties (South Texas) and in Bee and Refugio Counties (Lower Gulf Coast).

In West Texas the Turner gas field, Crockett County, was discovered, production being from the Whitehorse sandstone at about 1,900 feet. One wildcat gas completion was reported in Sutton County and one in Pecos County. Consideration is being given to gas injection for pressure maintenance in many West Texas fields as a conservation measure. Detailed study of the Colby, Slaughter, and Goldsmith fields is being carried on, which may develop information applicable to many other fields of similar characteristics. Goldsmith produced 16 billion cubic feet of gas in 1943 and Wasson over 13 billion. Many fields in the district produce 1 to 7 billion cubic feet per year, much of which is blown to the air. Hence it is hoped that both increased recovery of oil and conservation of great volumes of gas may result from an extensive pressure-maintenance program.

Utah.—There was no drilling in Utah during 1943, according to Ernest A. Hanson, supervisor, Geological Survey, United States Department of the Interior, Casper, Wyo.

The gross production of natural gas in the State, all from the Clay Basin field, decreased 11 percent—from 4,390 million cubic feet in 1942 to 3,893 million in 1943. Use in the field was estimated at 18 million cubic feet and losses at 10 million, leaving 3,865 million marketed. Comparative figures for 1942 were: Field use 1 million, losses 5 million, and marketed 4,384 million.

The Farnham dome produced 161 million cubic feet of carbon dioxide, which is not included in the foregoing figures. This gas is used in the manufacture of dry ice.

Virginia.—According to William M. McGill, assistant State geologist, Virginia Conservation Commission, the only natural-gas development reported in Virginia during 1943 was the completion of a well that was begun in 1942 in Lee County near Ewing. Gas was encountered with rather high pressures, but the well was capped at a depth of 3,255 feet. No wells were drilled in the Early Grove gas field which, to date, has furnished the only utilized production of the State, or in Rockingham and Prince William Counties, where some drilling activity was reported during 1941 and 1942.

Natural-gas production totaled 84,000,000 cubic feet in 1943 compared with 98,000,000 in 1942.

West Virginia.—The following information was taken from a report by David B. Reger, consulting geologist, Morgantown, W. Va.

About 39,000 acres were added to proved territory in West Virginia during 1943, both in new gas pools and in additions to old ones. Three gas pools discovered before 1943 became definitely active during the year. The output of new wells in all areas was disappointing, and it is doubtful whether additions to production will balance withdrawals.

Leasing of wildcat acreage continued to be active. Forty-two wildcat wells were drilled in 1943, of which 19 were completed as small, commercial gas wells. Comparative figures for 1942 were 53 wells drilled and 27 commercial gas discoveries.

There were 475 gas wells drilled during the year with total daily open-flow capacity of 454,735,000 cubic feet compared with 536 in 1942 and total daily open flow of 1,228,501,000 cubic feet. These figures indicate declines of 11 percent in the number of wells drilled and 63 percent in daily production. The average daily production per well was 957,337 cubic feet in 1943—58 percent less than the average of 2,270,406 cubic feet reported in 1942.

Fifty-seven old wells were deepened during the year, of which 49 were productive. They added 11,484,000 cubic feet of gas to daily productive capacity.

The direct cause of the slump in average well capacity was a sharp decline in completions in the Charleston gas field where wells producing from the Oriskany sand are usually large. There were 203 wells drilled in the field in 1942—only 80 in 1943. Other sources report that approximately half the gas production of West Virginia in 1942 was withdrawn from the Charleston deep field. In 1943 the field's output declined about 30 percent, but the area is expected to produce significant volumes of gas for a number of years.

Three of the seven wells drilled to the Newburg sand produced gas in commercial quantities. None reached the Clinton formation.

A number of promising gas pools have been developed in the Big Lime or Greenbrier sand in the southwestern part of the State. The formation is only 50 to 100 feet thick in the northern part and is generally unproductive, but it is productive farther south, where it thickens and is found at greater depths. The wells react to acid injection, and it is expected that great quantities of gas will be recovered. Initial flow ranges up to 13,000,000 cubic feet a day.

Jackson, Kanawha, and Putnam Counties were the most active in both 1942 and 1943. Counties of greatest development and the number of wells drilled were: Jackson 61, Kanawha 59, Putnam 48, Clay 47, Upshur 42, Lincoln 36, Boone 34, Gilmer 28, and Calhoun 20. Lincoln County with 10 wells and Lewis with 7 led in the number of wells deepened.

Some of the large gas companies are drilling input wells for gas storage in depleted fields in the northern part of the State, principally in Lewis County. The practice of storing a reserve supply close to areas of heavy consumption has increased in importance in recent years.

It is expected that the new pipe line from Texas will furnish about 175,000,000 cubic feet of gas daily to relieve present shortages.

Natural-gas production in West Virginia is estimated at 210,000,000,000 cubic feet in 1943, a 2-percent decline from the 215,193,000,000 reported in 1942.

Wyoming.—Only five gas completions were reported in Wyoming during 1943, all in the Baxter Basin field. Their total initial production was 18,960,240 cubic feet. The largest well ever reported in the Big Piney area found an initial flow of 40 million cubic feet, but it was killed with mud and was not counted as a gas completion. Several other Big Piney wells have had open flows exceeding 100,000 cubic feet. The occurrences of gas in the field are erratic, and pressures are as high as 480 pounds. There is no pipe-line outlet for the gas, which is remote from markets.

Gross production in the State in 1943 was 48,476 million cubic feet compared with 46,471 million in 1942. Of the total quantity, 13,992 million cubic feet were recycled or used for repressuring, 1,090 million were used in the field, and 1,474 million were lost. These figures indicate a 2-percent decrease in the volume of gas used for repressuring and recycling and a 22-percent decrease in the volume used in the field, but a 106-percent increase in losses, caused by an estimated waste of about 1 billion cubic feet of sour gas in the new Tensleep oil pool at Elk Basin. Without that item, losses would probably have decreased. The largest repressuring and recycling operations were in the Lance Creek field, where 5,501 million cubic feet of gas were returned to the sand (5 percent below the 1942 figure); the Salt Creek field, with a return of 5,797 million cubic feet (6 percent below the 1942 figure); and the Wertz field with 1,394 million cubic feet (19 percent above the 1942 record). Repressuring was practiced in the same eight fields as in 1942.

There were 23,298 million cubic feet of gas treated to produce 31,645 thousand gallons of gasoline in 1943, a gain of less than 1 percent in the volume of gas treated and a 5-percent decrease in the quantity of gasoline extracted. Salt Creek, Lance Creek, and Big Sand Draw furnished 96 percent of the total amount of gas processed in both 1942 and 1943.

Marketed production totaled 31,920 million cubic feet in 1943 compared with 30,029 million in 1942. The Sherard field was added to the number of areas from which gas was sold, making 33 fields in 1943. The areas of greatest production were: Baxter Basin with 8,159 million cubic feet, Big Sand Draw 6,128, Lance Creek 2,048, Little Buffalo Basin 2,017, and Salt Creek 2,966. These five fields furnished 67 percent of the total marketed production in Wyoming in 1943 and 66 percent in 1942.

The above information was furnished by Ernest A. Hanson, supervisor, Geological Survey, United States Department of the Interior, Casper, Wyo.

CONSUMPTION

The importance of natural gas as a fuel for wartime industries and in army encampments and Federal housing projects was well established in 1942. Total consumption reached an all-time high of 3,044,773 million cubic feet (9 percent above the 1941 peak of 2,805,192 million cubic feet) and was over twice the total volume consumed in 1917 and 1918 during the last war. Domestic and commercial use increased 16 percent and total industrial 7 percent in contrast with 1941, when the expansion in gas markets was almost entirely in the industrial classification.

Consumption expanded in all the States in 1942 except Washington, where natural gas is no longer used owing to exhaustion of the supply. Texas held first place, followed by Louisiana, California, and Oklahoma. Ohio produced only 31 percent of the State requirements and ranked first in imports from other States in both 1941 and 1942.

The average value of natural gas at points of consumption rose from 22.1 cents in 1941 to 22.7 cents in 1942. This increase was due to a shift in volume to high-priced gas. The average value of most of the major classes of consumption either declined or remained the same as in 1941, indicating that the trend in rates at which gas is sold was not upward.

Natural gas consumed in the United States, 1938–42

Year	Domestic and commercial consumption							
	Consumers (thousands) [1]			Billions of cubic feet			Average number of M cubic feet used per domestic and commercial consumer	Average value at points of consumption per M cubic feet (cents)
	Domestic	Commercial	Total	Domestic	Commercial	Total		
1938	8,570	695	9,265	368	114	482	52.0	68.3
1939	8,888	715	9,603	391	119	510	53.1	67.9
1940	9,245	741	9,986	444	134	578	57.9	65.7
1941	9,730	767	10,497	442	145	587	55.9	65.9
1942	10,135	779	10,914	498	184	682	62.5	63.4

Year	Industrial consumption							Total consumption		Electric public-utility power plants (billions of cubic feet) [2]
	Billions of cubic feet						Average value at points of consumption per M cubic feet (cents)	Billions of cubic feet	Average value at points of consumption per M cubic feet (cents)	
	Field	Carbon-black manufacture	Petroleum refineries	Portland cement plants [2]	Other industrial	Total industrial				
1938	659	325	110	37	681	1,812	9.4	2,294	21.8	170
1939	681	347	98	40	798	1,964	9.6	2,474	21.6	191
1940	712	369	128	42	826	2,077	9.5	2,655	21.7	183
1941	686	365	148	54	965	2,218	10.5	2,805	22.1	205
1942	721	336	202	64	1,040	2,363	10.9	3,045	22.7	239

[1] Includes consumers served with mixed gas.

[2] Chapters on Cement in Minerals Yearbook.

[3] Federal Power Commission: Figures include gas other than natural, impossible to segregate; therefore shown separately from main table.

Natural gas consumed in the United States, 1938–42, by States, in millions of cubic feet

State	1938	1939	1940	1941	1942
Alabama	14,796	20,093	23,461	32,023	36,287
Arizona	12,660	16,643	18,002	18,213	24,783
Arkansas	34,833	35,673	39,719	46,933	54,069
California	315,168	348,361	351,950	374,905	403,968
Colorado	19,212	21,978	22,111	26,574	28,860
District of Columbia	3,826	4,069	4,686	5,124	5,966
Florida	1,469	1,658	1,481	2,378	3,303
Georgia	14,783	16,296	20,551	23,975	31,996
Illinois	66,500	77,134	88,088	98,634	110,941
Indiana	26,706	30,795	29,214	29,989	37,642
Iowa	20,109	21,732	23,460	24,589	29,481
Kansas	86,105	85,865	96,772	109,059	121,354
Kentucky	15,350	16,563	18,881	20,170	21,382
Louisiana	162,260	164,667	185,089	222,025	253,894
Maryland	1,247	4,907	5,855	6,587	7,438
Michigan	24,697	27,316	32,790	37,290	42,202
Minnesota	14,641	17,262	19,904	22,672	29,116
Mississippi	12,785	14,207	17,657	20,813	26,444
Missouri	42,505	47,157	53,141	58,138	61,354
Montana	[1] 18,225	[1] 19,765	22,328	24,751	27,773
Nebraska	17,539	19,654	20,087	19,205	20,730
New Mexico	32,890	38,981	40,198	39,138	45,822
New York	47,950	46,877	27,250	25,384	27,150
North Dakota	1,533	1,607	1,725	1,741	1,904
Ohio	108,013	114,720	129,856	136,251	144,325
Oklahoma	244,443	231,005	230,806	209,395	220,991
Pennsylvania	96,285	109,746	121,230	139,492	143,187
South Dakota	5,354	5,712	6,454	6,580	7,611
Tennessee	14,047	[2] 15,558	16,819	22,495	22,806
Texas	729,603	796,561	874,294	875,620	917,657
Utah	11,699	13,172	14,802	16,667	18,920
Virginia	615	[2] 788	963	1,166	1,418
Washington	117	63	36	1	....
West Virginia	57,478	69,394	77,540	88,597	93,365
Wyoming	18,654	17,786	17,459	18,618	20,634
Total United States	2,294,097	2,473,765	2,654,659	2,805,192	3,044,773

[1] Includes natural gas piped from Canada.

[2] Small amount of gas consumed in Tennessee included with Virginia; separate figures not available.

Treated for natural gasoline.—Natural-gasoline plants processed 2,864,400 million cubic feet of natural gas in 1942—4 percent more than the 2,763,300 million processed in 1941. The ratio to total natural-gas consumption was 94 in 1942 compared with 99 in 1941. California registered a decline in the volume of gas treated for the fourth consecutive year. Colorado, Kentucky, Michigan, and New York were the only other States recording decreases. Louisiana was outstanding with a 29-percent increase, influenced by operation of the large Cotton Valley cycle plant which was active only a few months of 1941. The average yield of natural gasoline, including cycle products, was 0.95 gallon per thousand cubic feet of gas processed in 1942 compared with 0.97 gallon in 1941. An average recovery of 1.22 gallons of the lighter products was recorded in 1942 compared with 1.23 gallons in 1941.

Natural gas treated at natural-gasoline plants in the United States, 1938–42, by States, in millions of cubic feet

State	1938	1939	1940	1941	1942
Arkansas	21, 377	19, 171	26, 584	19, 906	25, 365
California	398, 187	377, 041	375, 407	371, 350	345, 191
Colorado	145	130	142	134	25
Illinois	1, 110	2, 440	12, 716	23, 732	25, 722
Kansas	144, 631	141, 945	150, 963	176, 088	179, 710
Kentucky	38, 446	36, 817	39, 662	38, 062	35, 408
Louisiana	116, 331	114, 960	145, 234	191, 194	247, 370
Michigan	1, 395	1, 019	1, 414	3, 581	1, 418
Montana	7, 126	8, 116	9, 528	10, 386	11, 728
New Mexico	97, 830	97, 010	101, 213	105, 161	108, 911
New York	65	65	40	5	4
Ohio	28, 488	32, 703	38, 547	37, 546	39, 851
Oklahoma	265, 746	219, 755	219, 255	200, 319	202, 653
Pennsylvania	22, 600	26, 662	40. 161	43, 704	46, 603
Texas	752, 784	914, 701	1, 123, 236	1, 325, 471	1, 372, 563
West Virginia	122, 301	140, 982	168, 206	195, 093	197, 643
Wyoming	17, 000	16, 483	19, 092	21, 568	24, 235
	2, 035, 562	2, 150, 000	2, 471, 400	2, 763, 300	2, 864, 400
Ratio to total consumption	89	87	93	99	94

Domestic and commercial.—Inadequate supplies of fuel oil and coal were among important factors reflected in the natural-gas industry in 1942 by a 13-percent gain in domestic and 27-percent gain in commercial consumption.

Domestic consumption totaled 498,537 million cubic feet valued at $352,520,000 in 1942 compared with 442,067 million cubic feet valued at $318,093,000 in 1941. Gains in both the number of domestic consumers and the total quantity consumed were registered in all States using natural gas except Montana, which had 1,540 fewer consumers. Commercial consumption totaled 183,603 million cubic feet valued at $80,189,000 in 1942 compared with 144,844 million cubic feet valued at $68,398,000 in 1941. Factors contributing to the increase in commercial consumption were the use of gas in many Army and Navy training stations and permanent bases and the increased use of restaurants and other commercial eating places by the civilian population because of rationed foods in homes and migration to places of employment in war industry. Decreased commercial consumption was reported in Mississippi and Missouri. All other States registered gains.

The average value of gas used by domestic consumers was 70.7

Domestic and commercial consumption of natural gas in the United States in 1942, by States[1]

State	Domestic				Commercial				Total			
	Consumers	M cubic feet	Value at points of consumption		Consumers	M cubic feet	Value at points of consumption		Consumers	M cubic feet	Value at points of consumption	
			Total	Average (cents)			Total	Average (cents)			Total	Average (cents)
Alabama	42,190	2,529,000	$2,381,000	94.1	3,920	985,000	$503,000	51.1	46,110	3,514,000	$2,884,000	82.1
Arizona	45,300	1,893,000	2,171,000	114.7	4,350	2,154,000	830,000	38.5	49,650	4,047,000	3,001,000	74.2
Arkansas	82,460	7,270,000	3,552,000	48.9	13,730	4,010,000	1,424,000	35.5	96,190	11,280,000	4,976,000	44.1
California	1,866,990	95,403,000	66,388,000	69.6	104,560	39,580,000	15,369,000	38.8	1,971,550	134,983,000	81,757,000	60.6
Colorado	107,980	7,762,000	5,772,000	74.4	10,070	2,450,000	1,380,000	56.3	118,050	10,212,000	7,152,000	70.0
District of Columbia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Florida	5,330	209,000	256,000	122.5	580	119,000	73,000	61.3	5,910	328,000	329,000	100.3
Georgia	100,930	6,424,000	5,324,000	82.9	8,150	5,382,000	1,781,000	33.1	109,080	11,806,000	7,105,000	60.2
Illinois	1,305,090	21,290,000	26,333,000	123.7	69,120	6,074,000	5,148,000	84.8	1,374,210	27,364,000	31,481,000	115.0
Indiana	202,590	4,603,000	5,398,000	117.3	11,230	1,371,000	1,090,000	79.5	213,820	5,974,000	6,488,000	108.6
Iowa	147,610	5,487,000	5,464,000	99.6	12,060	1,806,000	1,207,000	66.8	159,670	7,293,000	6,671,000	91.5
Kansas	233,760	19,647,000	11,757,000	59.8	27,950	11,048,000	3,415,000	30.9	261,710	30,695,000	15,172,000	49.4
Kentucky	184,270	10,041,000	5,831,000	58.1	17,020	3,093,000	1,447,000	46.8	201,290	13,134,000	7,278,000	55.4
Louisiana	214,150	11,669,000	7,322,000	62.7	22,560	8,960,000	2,772,000	30.9	236,710	20,629,000	10,094,000	48.9
Maryland	[2] 256,270	[2] 7,060,000	[2] 5,432,000	[2] 76.9	[2] 12,070	[2] 1,213,000	[2] 796,000	[2] 65.6	[2] 268,340	[2] 8,273,000	[2] 6,228,000	[2] 75.3
Michigan	738,420	25,700,000	25,140,000	97.8	30,330	4,583,000	3,765,000	82.2	768,750	30,283,000	28,905,000	95.4
Minnesota	175,210	7,100,000	6,230,000	87.7	8,620	2,766,000	1,348,000	48.7	183,830	9,866,000	7,578,000	76.8
Mississippi	59,980	4,474,000	3,305,000	73.9	8,290	2,895,000	1,071,000	37.0	68,270	7,369,000	4,376,000	59.4
Missouri	420,830	15,589,000	14,106,000	90.5	33,890	3,882,000	2,460,000	63.4	454,720	19,471,000	16,566,000	85.1
Montana	46,080	7,463,000	3,426,000	45.9	5,220	4,249,000	1,288,000	30.3	51,300	11,712,000	4,714,000	40.2
Nebraska	124,240	6,201,000	4,693,000	75.7	8,450	1,638,000	921,000	56.2	132,690	7,839,000	5,614,000	71.6
New Mexico	31,430	2,647,000	1,806,000	68.2	3,790	1,769,000	627,000	35.4	35,220	4,416,000	2,433,000	55.1
New York	429,670	16,860,000	13,913,000	82.5	38,400	3,767,000	2,668,000	70.8	468,070	20,627,000	16,581,000	80.4
North Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Ohio	1,281,320	69,783,000	45,050,000	64.6	115,830	14,152,000	7,916,000	55.9	1,397,150	83,935,000	52,966,000	63.1
Oklahoma	272,990	24,070,000	11,120,000	46.2	31,610	13,775,000	3,737,000	27.1	304,600	37,845,000	14,857,000	39.3
Pennsylvania	700,710	40,271,000	25,522,000	63.4	56,170	8,938,000	4,737,000	53.0	756,880	49,209,000	30,259,000	61.5
South Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Tennessee	56,870	4,274,000	3,143,000	73.5	6,970	3,090,000	1,195,000	38.7	63,840	7,364,000	4,338,000	58.9
Texas	721,870	43,047,000	28,888,000	67.1	87,330	19,947,000	7,800,000	39.1	809,200	62,994,000	36,688,000	58.2
Utah	[3] 52,960	[3] 4,937,000	[3] 3,374,000	[3] 68.3	[3] 3,770	[3] 2,626,000	[3] 976,000	[3] 37.2	[3] 56,730	[3] 7,563,000	[3] 4,350,000	[3] 57.5
Virginia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
West Virginia	204,060	21,270,000	7,741,000	36.4	19,820	5,447,000	1,826,000	33.5	223,880	26,717,000	9,567,000	35.8
Wyoming	23,210	3,564,000	1,682,000	47.2	2,970	1,834,000	619,000	33.8	26,180	5,398,000	2,301,000	42.6
Total: 1942	10,134,770	498,537,000	352,520,000	70.7	778,830	183,603,000	80,189,000	43.7	10,913,600	682,140,000	432,709,000	63.4
1941	9,730,110	442,067,000	318,093,000	72.0	766,910	144,844,000	68,398,000	47.2	10,497,020	586,911,000	386,491,000	65.9

[1] Includes natural gas used with manufactured gas.

[2] Maryland includes District of Columbia and Virginia.

[3] Utah includes North Dakota and South Dakota.

cents per thousand cubic feet in 1942, 1.3 cents less than in 1941. The average value of gas used by commercial consumers was 43.7 cents in 1942, 3.5 cents less than in 1941.

The average domestic consumer used 49,191 cubic feet of gas in 1942 compared with 45,433 in 1941.

Field.—Twenty-four percent (721,063 million cubic feet) of the total consumption of natural gas was used in the field in 1942—5 percent above the 1941 figure of 686,158 million cubic feet. Drilling was reduced because of shortages in manpower and materials; hence this gain was probably due to a more extensive use of gas lift in oil fields in a few States. There was an indicated decline of 0.2 cent per thousand cubic feet in the average value of gas used in the field in 1942, caused largely by a 10-percent increase in field consumption in Texas, where gas is relatively cheap.

Carbon-black manufacture.—A 3-percent decline from the 1941 carbon-black output, together with a further increase in the proportion of high-yield furnace blacks produced in 1942, caused a decrease in the amount of gas burned at carbon-black plants. A total of 335,533 million cubic feet was used—8 percent less than the 365,377 million used in 1941. The average value increased 0.2 cent over the 1941 figure to 1.3 cents a thousand cubic feet. The total value was $4,338,000 compared with $4,135,000 in 1941. California and New Mexico were added in 1942 to the list of States in which gas is burned in carbon-black manufacture.

Petroleum refineries.—Natural gas furnished 24 percent of the B. t. u. requirements of petroleum refineries in 1942 compared with 18 percent in 1941. The industry used 201,670 million cubic feet in 1942—36 percent over the 148,127 million used in 1941. Texas, California, and Louisiana were the largest consumers in both years. California displaced Louisiana as second in rank in 1942. The urgent demand for fuel oil for other war purposes caused large-scale conversions from oil to gas fuel at refineries in both Texas and California.

Electric public-utility power plants.—Electric public-utility power plants used 238,736 million cubic feet of gas in 1942, a 16-percent gain over the 205,156 million used in 1941. The figures as reported by the Federal Power Commission include a small percentage of manufactured gas. States registering sharp gains over 1941 records were: Georgia 115 percent, Minnesota 91, Indiana 67, Arizona 62, Colorado 51, Oklahoma 28, and Texas 26. States showing sharp decreases were: Pennsylvania 64 percent, Wyoming 50, Alabama 24, Tennessee 20, and Mississippi 14. Texas, Louisiana, and Kansas recorded the largest amounts of this class of consumption. The region of greatest increase was the south Atlantic, with a 114-percent gain over the 1941 record. The east south central area, with a 19-percent decline, was the region of greatest decrease. The west south central region led in the volume of gas consumed, with 132,040 million cubic feet—18 percent over the 1941 figure and 55 percent of the 1942 total.

Portland-cement plants.—Natural gas consumed at portland-cement plants totaled 64,540 million cubic feet in 1942—19 percent over the amount required in 1941. This gain was due to increased output of portland cement rather than to substitution of gas for fuel oil, as plants using the latter converted to coal wherever possible. In the winter of 1942–43 gas deliveries to several plants, particularly in the Kansas-Missouri district, were curtailed because of local shortages in supply. Conversions to coal and oil reduced the demand for natural gas in 1943.

Other industrial.—Gas used at electric public-utility power plants, as reported by the Federal Power Commission, includes some manufactured gas impossible to segregate. The natural gas used at such plants is therefore included with "other" industrial in the 1942 figures.

Heavy loads for war industries and allied plants in 1942 contributed to a continuation of the increase in "other" industrial consumption, which has been uninterrupted since 1938. A total of 1,039,827 million cubic feet was used during the year compared with 964,441 used in 1941. The gain was general, except in California, Tennessee, Kentucky, and Ohio, where small declines were reported as a result of restricted gas supplies and conversions to oil and coal.

The average value of gas used at petroleum refineries, electric public-utility plants, and portland-cement plants and for "other" industrial purposes remained unchanged at 17.1 cents a thousand cubic feet. The total value in 1942 was $223,535,000; in 1941, $199,419,000.

Mixed gas.—The quantity of natural gas used with manufactured gas increased 17 percent in 1942 to 77,259 million cubic feet from 65,979 million in 1941. Increases were indicated in all States using mixed gas. Illinois, the largest consumer, gained 6 percent and New York, second in rank, 18 percent. In general, the unit value of high-priced domestic and commercial gas decreased, while that of lower-priced industrial gas increased, resulting in a lower average value for all gas of 83.0 cents a thousand cubic feet in 1942 compared with 86.3 cents in 1941. The total value was $64,093,000 in 1942; $56,952,000 in 1941.

Industrial consumption of natural gas in the United States in 1942, by States and uses

State	Field (drilling, pumping, and operating gasoline-recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants [1]
	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet				Value at points of consumption		M cubic feet	Value at points of consumption		M cubic feet
				Total	Average (cents)	Petroleum refineries	Portland-cement plants	Other industrial	Total	Total	Average (cents)		Total	Average (cents)	
Alabama							(²)	[2] 32,773	32,773	$5,448	16.6	32,773	$5,448	16.6	679
Arizona								20,736	20,736	4,169	20.1	20,736	4,169	20.1	3,704
Arkansas	11,362	$572				5,032	(²)	[2] 26,395	31,427	3,413	10.9	42,789	3,985	9.3	4,895
California	116,032	7,727	(³)	(³)	(³)	33,931	15,542	[3] 103,480	[3] 152,953	[3] 20,520	[3] 13.4	268,985	28,247	10.5	12,062
Colorado	222	18				1	(²)	[2] 18,425	18,426	2,814	15.3	18,648	2,832	15.2	1,132
District of Columbia								(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	(⁴)	
Florida								2,975	2,975	457	15.4	2,975	457	15.4	
Georgia								20,190	20,190	3,561	17.6	20,190	3,561	17.6	12,334
Illinois	11,645	412				925		71,007	71,932	15,989	22.2	83,577	16,401	19.6	2,371
Indiana	265	18						31,403	31,403	7,454	23.7	31,668	7,472	23.6	8,910
Iowa							(²)	[2] 22,188	22,188	3,895	17.6	22,188	3,895	17.6	6,066
Kansas	19,716	1,144	(³)	(³)	(³)	5,529	10,494	[3] 54,920	[3] 70,943	[3] 8,823	[3] 12.4	90,659	9,967	11.0	21,314
Kentucky	1,960	275				9		6,279	6,288	1,778	28.3	8,248	2,053	24.9	
Louisiana	81,305	3,050	18,040	504	2.8	28,134	(²)	[2] 105,786	133,920	13,461	10.1	233,265	17,015	7.3	35,142
Maryland								[4] 6,549	[4] 6,549	[4] 2,030	[4] 31.0	[4] 6,549	[4] 2,030	[4] 31.0	
Michigan	798	58				41		11,080	11,121	5,886	52.9	11,919	5,944	49.9	15
Minnesota								19,250	19,250	3,654	19.0	19,250	3,654	19.0	5,116
Mississippi	650	42						18,425	18,425	2,854	15.5	19,075	2,896	15.2	1,514
Missouri	718	88					(²)	[2] 41,165	41,165	7,609	18.5	41,883	7,697	18.4	10,668
Montana	1,579	88				1,600		12,882	14,482	1,943	13.4	16,061	2,031	12.6	1,032
Nebraska							(²)	[2] 12,891	12,891	2,420	18.8	12,891	2,420	18.8	5,013
New Mexico	21,190	401	(³)	(³)	(³)	171		[3] 20,045	[3] 20,216	[3] 2,367	[3] 11.7	41,406	2,768	6.7	4,160
New York	252	66				27		6,244	6,271	3,434	54.8	6,523	3,500	53.7	28
North Dakota								(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	245
Ohio	1,527	250				1		58,862	58,863	22,869	38.9	60,390	23,119	38.3	1,812
Oklahoma	114,170	3,298	(³)	(³)	(³)	13,325	(²)	[2] [3] 55,651	[3] 68,976	[3] 6,105	[3] 8.9	183,146	9,403	5.1	16,597
Pennsylvania	6,528	1,797				611		86,839	87,450	28,144	32.2	93,978	29,941	31.9	4
South Dakota							(²)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	(⁵)	1,572
Tennessee								15,442	15,442	2,576	16.7	15,442	2,576	16.7	6,546

See footnotes at end of table.

Industrial consumption of natural gas in the United States in 1942, by States and uses—Continued

State	Field (drilling, pumping, and operating gasoline-recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utilities power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants[1]
	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet				Value at points of consumption		M cubic feet	Value at points of consumption		M cubic feet
				Total	Average (cents)	Petroleum refineries	Portland-cement plants	Other industrial	Total	Total	Average (cents)		Total	Average (cents)	
Texas	310,478	8,879	299,479	3,303	1.1	107,231	16,139	121,336	244,706	25,336	10.4	854,663	37,518	4.4	75,407
Utah	2	(6)				110	(2)	[2] [5] 20,760	[5] 20,870	[5] 2,865	[5] 13.7	[5] 20,872	[5] 2,865	[5] 13.7	30
Virginia								(4)	(4)	(4)	(4)	(4)	(4)	(4)	
West Virginia	12,729	2,107				1,622		52,297	53,919	11,304	21.0	66,648	13,411	20.1	17
Wyoming	7,935	297				3,370		3,931	7,301	886	12.1	15,236	1,183	7.8	351
Miscellaneous			[3] 18,014	[3] 531	[3] 2.9		[2] 22,365								
Total: 1942	721,063	30,587	335,533	4,338	1.3	201,670	64,540	1,039,827	1,306,037	223,533	17.1	2,362,633	258,458	10.9	238,736
1941	686,158	29,993	365,377	4,135	1.1	148,127	54,208	964,411	1,166,746	199,419	17.1	2,218,281	233,547	10.5	205,156

[1] Federal Power Commission: Figures include gas other than natural, impossible to segregate; therefore shown separately from main table.

[2] Gas used in portland-cement plants included under "Miscellaneous" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[3] Gas used in carbon-black manufacture included under "Miscellaneous" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[4] Maryland includes District of Columbia and Virginia.

[5] Utah includes North Dakota and South Dakota.

[6] Less than $500.

Consumption of natural gas used with manufactured gas in the United States in 1942, by States.

State	Domestic		Commercial		Industrial (M cubic feet)	Total	
	Consumers	M cubic feet	Consumers	M cubic feet		M cubic feet	Value at points of consumption
District of Columbia	175,860	4,641,000	8,560	704,000	621,000	5,966,000	$4,083,000
Illinois	1,079,480	16,183,000	53,150	4,751,000	6,305,000	27,239,000	25,718,000
Indiana	57,820	786,000	2,840	249,000	922,000	1,957,000	1,642,000
Iowa	58,690	1,293,000	3,980	231,000	302,000	1,826,000	1,619,000
Kentucky	82,400	3,083,000	7,280	1,391,000	1,206,000	5,680,000	3,070,000
Maryland	27,400	886,000	520	35,000	29,000	950,000	781,000
Minnesota	145,180	4,821,000	5,470	686,000	12,000	5,519,000	4,986,000
Missouri	253,280	4,700,000	11,790	809,000	682,000	6,191,000	6,459,000
Nebraska	57,370	1,328,000	330	78,000	163,000	1,569,000	952,000
New York	309,370	9,143,000	23,540	1,877,000	2,255,000	13,275,000	10,180,000
Ohio	178,120	2,257,000	16,910	795,900	906,000	3,958,000	2,311,000
Pennsylvania	61,570	1,892,000	2,810	342,000	322,000	2,556,000	1,730,000
Virginia	27,920	456,000	860	96,000	21,000	573,000	562,000
Total: 1942	2,514,460	51,469,000	138,040	12,044,000	13,746,000	77,259,000	64,093,000
1941	2,479,210	45,454,000	139,890	9,763,000	10,762,000	65,979,000	56,952,000

INTERSTATE SHIPMENTS

Interstate shipments, which have been expanding since 1938, increased 13 percent over the 1941 record and totaled 919,969 million cubic feet in 1942. All "exporting" States reported increases except Mississippi, Missouri, New York, Utah, and Virginia, none of which is an important supplier to outside areas. Oklahoma gained 64 percent over the volume reported in 1941, Colorado 54 percent, New Mexico 26 percent, and Texas 14 percent. Texas again held first place in the quantity transported (supplying 32 percent of the total), Louisiana was second with 22 percent, and West Virginia ranked third with 16 percent. Louisiana exported 46 percent, West Virginia 66 percent, and Texas 25 percent of the marketed State production.

Interstate transportation of natural gas in 1942 [1]

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Arkansas		Louisiana	4,006
		Texas	345
			4,351
Colorado	Wyoming	Utah	4,348
		Wyoming	163
			4,511
Illinois		Indiana	429
	Indiana	Kentucky	535
			964
Indiana		do	474
Kansas		Colorado	760
	Missouri	Illinois	2,755
	do Illinois	Indiana	5,217
	Nebraska	Iowa	8,199
	do South Dakota	do	22
	Missouri Illinois Indiana Ohio	Michigan	7,670
	Nebraska Iowa	Minnesota	11,632
		Missouri	10,527
		Nebraska	9,419
	Nebraska Iowa	do	2
	Missouri Illinois Indiana	Ohio	247
		Oklahoma	659
	Nebraska	South Dakota	1,234
			58,348
Kentucky	West Virginia Virginia Maryland	District of Columbia	5,966
		Indiana	155
	West Virginia Virginia	Maryland	5,307
	West Virginia Virginia Maryland District of Columbia	do	969
		Ohio	3,856
	West Virginia	do	5,000
	do	Pennsylvania	22,449
	do	Virginia	787
	do Virginia Maryland District of Columbia	do	573
		West Virginia	18,450
			63,512
Louisiana	Mississippi	Alabama	32,634
		Arkansas	29,450
	Mississippi Alabama	Florida	3,243
	Mississippi Alabama	Georgia	27,966
	Arkansas Missouri	Illinois	22,069
		Mississippi	21,018
	Arkansas	do	2,854
	do	Missouri	12,115
	do Missouri Illinois	do	7,250
	Arkansas Mississippi	Tennessee	22,762
		Texas	23,302
	Arkansas	do	1,961
			206,633

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1942 [1]—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Mississippi		Alabama	177
	Alabama	Florida	60
		Louisiana	32
			269
Montana		North Dakota	1,904
	North Dakota	South Dakota	4,404
			6,308
New Mexico	Texas New Mexico	Arizona	24,783
		Colorado	245
	Texas New Mexico Arizona	Mexico	1,182
		Texas	8,000
			34,210
New York		Canada	34
		Pennsylvania	811
			845
North Dakota	Montana North Dakota	South Dakota	122
Ohio		West Virginia	123
Oklahoma		Arkansas	3,511
	Kansas Missouri	Illinois	86
	Kansas Missouri Illinois	Indiana	164
	Kansas Nebraska	Iowa	1,844
	Kansas Nebraska South Dakota	do	5
		Kansas	33,577
	Kansas Missouri Illinois Indiana Ohio	Michigan	262
	Kansas Nebraska Iowa	Minnesota	2,616
	Kansas	Missouri	12,503
	do	Nebraska	1,839
	do Nebraska Iowa	do	1
	Kansas Missouri Illinois Indiana	Ohio	8
	Kansas Nebraska	South Dakota	277
		Texas	7,108
			63,801
Pennsylvania	New York	Canada	96
		New York	19,277
		Ohio	112
	West Virginia	do	275
		West Virginia	2,524
			22,284
Texas	Louisiana Mississippi	Alabama	3,476
		Arkansas	494
	Louisiana	do	5,509
	New Mexico	Colorado	27,501
	Louisiana Mississippi Alabama	Georgia	4,030
	Oklahoma Kansas Missouri	Illinois	6,756

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[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1942 [1]—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Texas	Oklahoma Kansas Nebraska Iowa	Illinois	65,755
	Oklahoma Kansas Missouri Illinois	Indiana	12,797
	Oklahoma Kansas Nebraska Iowa Illinois	do	17,755
	Oklahoma Kansas Nebraska	Iowa	19,382
	Oklahoma Kansas Nebraska South Dakota	do	29
	Oklahoma	Kansas	33,199
		Louisiana	8,803
		Mexico	7,390
	Oklahoma Kansas Missouri Illinois Indiana Ohio	Michigan	18,749
	Oklahoma Kansas Nebraska Iowa	Minnesota	14,868
	Louisiana	Mississippi	759
	Oklahoma Kansas	Missouri	18,850
	Oklahoma Kansas	Nebraska	7,989
	Oklahoma Kansas Nebraska Iowa	do	3
		New Mexico	1,868
	Oklahoma Kansas Missouri Illinois Indiana	Ohio	607
		Oklahoma	14,429
	Oklahoma Kansas Nebraska	South Dakota	1,567
	New Mexico Colorado	Wyoming	839
			293,404
Utah		do	182
Virginia		Tennessee	34
West Virginia		Kentucky	3,796
		Maryland	1,162
		Ohio	86,184
	Kentucky	do	3,104
		Pennsylvania	48,370
	Maryland	do	309
			142,925
Wyoming		Montana	2,606
		Nebraska	1,477
		Utah	9,591
			13,674
			919,969

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[1] Includes exports to Canada and Mexico.

PIPE-LINE DEVELOPMENTS

At the beginning of the war, existing lines were generally adequate for the transportation of natural gas for current markets. Hence in 1942 few major additions were made to the gas-pipe-line system of the country. Guided by the allocation program of the War Production Board for critical steel and equipment, emphasis was first placed upon construction of oil pipe lines, for which there was a most urgent need. By 1943 the rapid growth in natural-gas demand from war industries and other consumers overtaxed the transmission facilities in several areas, notably in western Pennsylvania, Ohio, western Missouri, and southern California. To avoid shortages that would hinder the war program in these districts, the Federal Power Commission authorized the construction of several large gas lines and numerous extensions and loops with materials released by the War Production Board.

The outstanding project of the year was a line from a point near Corpus Christi, Tex., to Charleston, W. Va., to carry Texas gas to eastern markets. Strong opposition was encountered from interests in gas-producing States involved; but the Federal Power Commission finally issued a certificate of convenience to build, with the provision that the work be started before February 1944 and the line be ready for use by the winter of 1944–45. Construction was begun the first week of December on the Cumberland River northwest of Nashville, Tenn.

Another project to supplement the gas supply from eastern fields was completed in 1943. It consisted of 120 miles of 20-inch line running from the system of the Panhandle Eastern Pipe Line Co. near Maumee, Ohio, to the lines of the East Ohio Gas Co., which supply the industrial areas near Cleveland and Akron. A supply of 50 million cubic feet per day of gas from the Southwest is assured by this connection. To provide capacity to meet increasing demands, the Panhandle Eastern Pipe Line Co. added over 200 miles of 22- to 26-inch pipe to its transmission system in eight loops and installed 24,600 hp. of new compressor-station equipment.

The construction by the Cities Service Transmission & Chemical Co. of 235 miles of 26-inch line from the Oklahoma-Panhandle area of the Hugoton field to Blackwell, Okla., was almost completed in December, and the line was placed in service early in 1944.

Among a number of minor extensions and loops added to existing lines in 1943 were: A 60-mile line of 8-inch pipe between Muskegon, Mich., and the Reed City field; 35 miles of 16- and 12-inch loops from a point north of the Cayuga field to the vicinity of Alma, Tex.; and 35 miles of 12-inch line from the Lula field, Coal County, Okla., to Holdenville.

An application was filed to build a 1,500-mile line from Texas and Louisiana gas fields to transport gas to New York City for wholesale distribution. No official action was taken on the proposal during the year. An application for permission to build a line from the Texas Panhandle to Milwaukee, Wis., was withdrawn in 1943 as currently impractical.

NATURAL GASOLINE

AND LIQUEFIED PETROLEUM GASES[1][2]

By F. S. Lott[3] and A. T. Coumbe

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NATURAL GASOLINE

SUMMARY

The products of the natural-gasoline industry were in great demand in 1943 at rising prices. Output increased 6 percent over 1942 to 3,703,518 thousand gallons, and total value at the plants was 21 percent higher at $147,000,000. The outstanding gain was in the production of liquefied petroleum gases, as the output of natural gasoline continued to decline in 1943, and cycle products gained comparatively little.

A strong market throughout 1943 is indicated by the Mid-Continent spot price for 26–70 grade natural gasoline, which began the year at 3.88 cents per gallon and rose to 4.75 cents at the close to average 4.13 cents as compared with 3.22 in 1942. The average values of all light products, as reported to the Bureau of Mines, were higher in 1943 than in 1942.

Total stocks declined less than 4 million gallons in 1943, reversing a small increase in 1942. Gains in stocks of cycle products and liquefied petroleum gases, chiefly at refineries, were more than balanced by a reduction of 27 million gallons in natural-gasoline stocks.

Exports have declined during the war period to low levels. The principal movements for 1941, 1942, and 1943 are summarized in this chapter, as this information was omitted after 1940 owing to war restrictions.

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[1] Data for 1943 are preliminary; detailed statistics with final revisions will be released later.
[2] In this report the term "billion" is equivalent to 1,000,000,000.
[3] Tables compiled by E. M. Seeley, Petroleum Economics Division, Bureau of Mines.

Salient statistics of the natural-gasoline industry in the United States, 1939–43, in thousands of gallons

	1939	1940	1941	1942	1943 [1]
Production:					
Natural gasoline	2, 129, 946	2. 173, 710	2, 208, 360	2. 071, 104	2, 025, 744
Cycle products, except liquefied petroleum gases	39, 354	165, 690	480, 354	654, 864	682, 794
Liquefied petroleum gases at natural gasoline and cycle plants:					
Isobutane	(2)	(2)	127, 932	101, 682	170, 184
Other L. P. G	(2)	(2)	579, 264	671, 874	824, 796
Benzol	(2)	(2)	(2)	100, 674	100, 800
Total	2, 169, 300	2. 339, 400	3, 395, 910	3, 600, 198	3, 804, 318
Stocks at plants, terminals, and refineries, end of year:					
Natural gasoline	185, 682	239, 568	171, 276	157, 374	130, 410
Cycle products			8, 274	13, 524	15, 288
Liquefied petroleum gases	(2)	(2)	6, 804	23, 646	45, 024
Total	185, 682	239, 568	[3] 179, 550 186, 354	194, 544	190, 722
Demand:					
Used at refineries	1, 663, 452	1, 660, 974	2, 008, 650	2, 376, 990	2, 570, 316
Sales to jobbers, retailers, etc.:					
Natural gasoline and cycle products	171, 066	283, 290	837, 858	415, 800	292, 152
L. P. G. for fuel	(2)	(2)	263, 802	302, 190	407, 358
Transfers of cycle products	(2)	(2)	(2)	(2)	66, 108
Exports [4]	172, 662	71, 526	53, 886	57, 414	35, 154
Losses and unidentified uses [5]	179, 298	269, 724	291, 732	439, 614	437, 052
Total	2, 186, 478	2, 285, 514	3, 455, 928	3, 592, 008	3, 808, 140
Sales to consumers for fuel and chemical uses: [6]					
Liquefied refinery gases	223, 580	313, 456	199, 038	223, 272	170, 898
Liquefied petroleum gases			263, 814	362, 168	504, 335
Total	223, 580	313, 456	462, 852	585, 440	675, 233
Value at plants:					
Natural gasoline......thousands of dollars	90. 050	68, 261	88, 877	78, 170	93, 000
Cycle products......do			16, 938	24, 395	28, 000
Liquefied petroleum gases......do	(2)	(2)	13, 305	19, 000	26, 000
Average per gallon......cents	4. 2	2. 9	3. 5	3. 5	4. 0
Natural gas treated......millions of cubic feet	2, 150, 000	2, 471, 400	2, 763, 300	2, 864, 400	[7] 2, 900, 000
Average yield of natural gasoline per M cubic feet......gallons	1. 01	0. 95	0. 97	0. 95	[7] 0. 93
Average yield, all light products......do	(2)	(2)	1. 23	1. 22	[7] 1. 28

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[1] Subject to revision.
[2] Not available.
[3] For comparison with 1940.
[4] Figures from data compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.
[5] Includes liquefied gases used in chemical manufacturing.
[6] From independent survey of consumption. See discussion on Liquefied Petroleum Gases at the end of this chapter.
[7] Estimated.

PRICES AND MARKET CONDITIONS

After recovering from a low of 2.25 cents per gallon in March 1942 to reach 3.88 cents in December, the Mid-Continent spot price for 26–70 grade natural gasoline remained constant until August 24, 1943. Then upward adjustments were made until a price of 4.75 cents was established on October 8, 1943, and held through the end of the year.

The price ceiling set by the Office of Price Administration on this grade of natural in Oklahoma has been 4.875 cents per gallon f. o. b. plants since February 1942; hence the spot price has closely approached the ceiling level for the first time. Special products, such as isobutane, which are required for the synthetic rubber and aviation-gasoline programs, were exempted from price restrictions to encourage increased output.

The average value at plants of natural gasoline and cycle products (partly estimated) increased sharply in 1943 to 4.5 cents per gallon from 3.8 cents in 1942, and approached the average spot motor-fuel (Oklahoma 72–74 octane) price (see fig. 1).

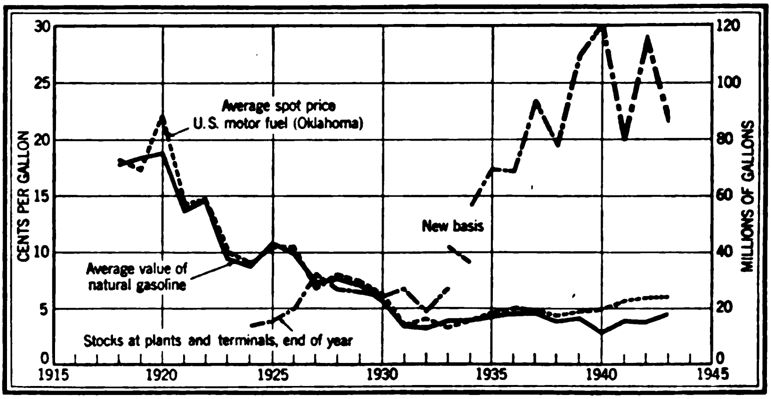

FIGURE 1.—Trends in average value of natural gasoline, spot price of gasoline, and stocks of natural gasoline, 1918–43.

Prices to blenders of Mid-Continent natural gasoline, grade 26–70, with dates of price changes in 1943 and monthly and yearly average, in cents per gallon

[National Petroleum News]

Date	Cents	Date	Cents	Date	Cents
Jan. 1	3.88	July: Average	3.88	Oct. 8	4.75
Average	3.88	Aug. 24	4.13	Average	4.69
		Aug. 28	4.30		
February: Average	3.88			November: Average	4.75
		Average	3.97		
March: Average	3.88			December: Average	4.75
		Sept. 4	4.13–4.38		
April: Average	3.88	Sept. 7	4.13	Average: 1943	4.13
		Sept. 11	4.13–4.38	1942	3.22
May: Average	3.88	Sept. 14	4.25–4.63		
		Sept. 15	4.25–4.38		
June: Average	3.88	Sept. 16	4.25		
		Sept. 28	4.50		
		Average	4.29		

The higher average value of natural in 1943 resulted chiefly from firmer market conditions in the important Texas and Louisiana producing district. Large gains in output from this area for which lower than average prices at the plants were obtained have tended in recent years to depress the national average value of natural gasoline relative to the Oklahoma motor-fuel price.

PRODUCTION

Trends in total output.—Production of natural gasoline and cycle products (except L. P. G.) in 1943 was slightly less than in 1942, but crude petroleum output increased 8 percent to a new record, as figure 2 indicates. Since 1939 the volume of natural-gasoline output has changed little, as sharp gains have been recorded in cycle products and liquefied petroleum gases. These data record the effects upon production of growing cycle-plant operations; the installation and use of fractionating facilities at natural-gasoline plants; and, as a minor factor, the practice followed by some companies of crediting plant output with products separated at refineries from unfractionated material received from plants.

Total liquid production by the industry (natural gasoline, cycle products, and L. P. G.) was 3,703.5 million gallons in 1943, 6 percent above 1942. Monthly output was stable during the first half of 1943 at a rate comparable with the fourth quarter of 1942. Several new plants, particularly two large cycle plants in Texas, contributed to a higher rate of production in the latter months of 1943. The fourth-quarter average was almost 800 thousand gallons per day above that of the first quarter.

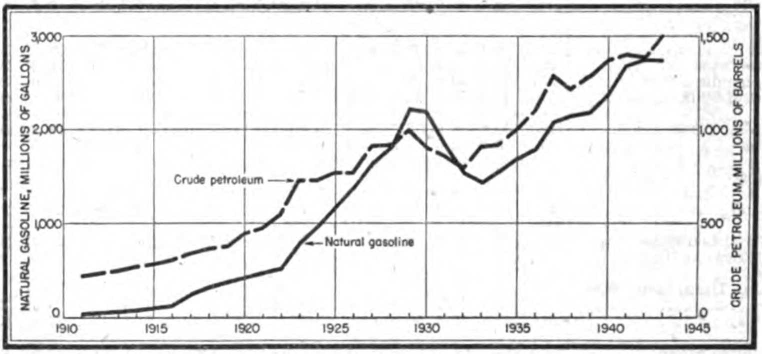

FIGURE 2.—Annual production of natural gasoline and crude petroleum, 1911–43.

Natural gasoline and cycle products produced in the United States, 1939–43, by States, in thousands of gallons

Year	Arkansas	California	Colorado	Illinois	Kansas	Kentucky	Louisiana	Michigan	Montana	New Mexico
1939	24, 634	607, 237	390	4, 012	62, 175	7, 785	94, 090	2, 971	2, 161	54, 707
1940	32, 096	587, 476	380	21, 499	64, 691	9, 539	113, 741	3, 919	2, 603	55, 713
1941	28, 108	577, 127	390	54, 872	72, 876	10, 247	201, 049	5, 670	2, 517	69, 115
1942	34, 033	545, 881	346	66, 389	68, 948	8, 884	254, 362	2, 518	2, 810	73, 862
1943 [1]	39, 737	583, 181	174	71, 928	69, 870	10, 551	235, 344	1, 293	2, 748	72, 749

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming [2]	Total		
								Thousands of gallons [3]	Value at plant	
									Thousands of dollars	Average per gallon (cents)
1939	34	7, 445	436, 123	11, 756	770, 047	52, 272	31, 461	2, 169, 300	90, 050	4. 2
1940	17	8, 062	399, 369	15, 371	932, 040	58, 782	34, 102	2, 339, 400	68, 261	2. 9
1941	17	8, 217	362, 247	15, 440	1, 180, 221	65, 873	34, 728	2, 688, 714	105, 815	3. 9
1942	15	6, 975	336, 707	14, 876	1, 207, 901	67, 987	33, 474	2, 725, 968	102, 565	3. 8
1943 [1]	14	6, 473	307, 384	16, 982	1, 192, 526	66, 804	30, 780	2, 708, 538	121, 000	[4] 4. 5

[1] Subject to revision.

[2] Includes Utah in 1939–40.

[3] Includes cycle products as follows—1939: 39,354,000 gallons; 1940: 165,690,000 gallons; 1941: 480,354,000 gallons; 1942: 654,864,000 gallons; 1943: 682,794,000 gallons.

[4] Estimated.

California.—Natural-gasoline production reversed a decline of 4 years duration in 1943, gaining 7 percent over 1942 to reach 583,181 thousand gallons. Liquefied-petroleum-gas output continued to in-

Monthly production of natural gasoline and allied products in the United States, 1942-43, by States and districts, in millions of gallons

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1942													
West New York and West Pennsylvania	1.8	1.6	1.7	1.5	1.0	0.8	0.7	0.8	1.0	1.3	1.4	1.7	15.3
West Virginia	10.7	9.8	9.3	8.5	8.2	6.5	6.6	7.1	7.1	8.5	9.2	10.3	101.8
Ohio	1.0	.8	.8	.6	.5	.4	.3	.4	.5	.6	.5	.6	7.0
Illinois	10.8	10.2	11.3	11.0	10.9	11.1	11.5	11.3	11.8	13.3	12.9	13.2	139.3
Kentucky	3.3	3.2	2.9	2.9	2.8	2.7	2.6	2.8	2.9	3.3	3.4	3.9	36.7
Michigan	.3	.2	.2	.2	.3	.2	.3	.2	.2	.2	.1	.1	2.5
Kansas	7.9	7.3	7.4	6.2	6.2	5.6	5.9	6.1	6.7	7.0	7.6	7.9	81.8
Oklahoma	37.8	35.0	37.8	34.5	36.4	36.4	36.8	37.7	37.9	38.9	37.5	38.4	445.1
Texas:													
Gulf	27.9	26.1	27.3	21.7	21.9	19.9	20.6	23.0	23.9	25.4	25.8	26.1	289.6
East Texas	26.9	24.4	23.1	16.5	23.5	24.4	24.2	30.4	28.5	28.7	26.5	26.3	303.4
Panhandle	37.6	31.5	33.8	29.1	31.1	31.2	32.7	29.9	31.1	31.9	34.5	38.0	392.4
Rest of State	53.6	48.6	51.8	45.4	48.8	47.5	49.5	48.4	47.5	48.0	45.5	47.8	582.4
Total Texas	146.0	130.6	136.0	112.7	125.3	123.0	127.0	131.7	131.0	134.0	132.3	138.2	1,567.8
Arkansas	3.5	3.2	3.5	3.3	3.5	3.6	3.7	3.7	3.7	3.8	3.7	3.5	42.7
Louisiana:													
Gulf	5.7	5.1	5.6	5.5	6.2	5.3	6.1	6.3	6.6	6.8	6.4	7.3	72.9
Inland	21.4	18.8	18.2	13.6	16.9	18.2	18.3	19.1	19.0	19.7	19.6	20.4	223.2
Total Louisiana	27.1	23.9	23.8	19.1	23.1	23.5	24.4	25.4	25.6	26.5	26.0	27.7	296.1
New Mexico	7.3	6.8	7.5	6.9	7.1	7.0	7.8	8.2	7,7	7.7	7.6	7.6	89.2
Montana	.5	.4	.4	.4	.3	.4	.3	.3	.3	.3	.4	.5	4.5
Colorado, Utah, and Wyoming	3.1	2.8	3.1	2.8	2.9	2.7	2.9	3.1	3.0	3.4	3.3	3.3	36.4
California	54.9	49.9	50.6	50.4	51.9	49.8	53.2	54.7	53.2	54.8	52.9	57.0	633.3
Total United States	316.0	285.7	296.3	261.0	280.4	273.7	284.0	293.5	292.6	303.6	298.8	313.9	3,499.5
Daily average	10.2	10.2	9.6	8.7	9.0	9.1	9.2	9.5	9.8	9.8	10.0	10.1	9.6
1943[1]													
West New York and West Pennsylvania	1.8	1.6	1.8	1.7	1.2	.9	.9	1.1	1.3	1.6	1.7	1.8	17.4
West Virginia	9.9	9.6	10.1	9.1	7.8	6.2	6.7	6.6	6.9	8.0	8.9	8.7	98.5
Ohio	.6	.6	.7	.5	.5	.4	.4	.4	.4	.6	.6	.8	6.5
Illinois	13.4	12.7	13.8	14.1	14.5	14.5	14.8	15.9	16.5	18.3	17.9	17.7	184.1
Kentucky	4.1	3.9	4.5	4.1	3.4	2.8	3.0	3.1	3.4	3.8	3.5	3.6	43.2
Michigan	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.2	1.3
Kansas	7.6	7.4	7.3	6.8	6.6	6.2	6.3	6.6	7.2	7.7	7.8	7.3	84.8
Oklahoma	36.4	34.4	36.1	34.5	34.6	34.1	34.8	35.4	35.0	37.0	35.0	34.9	422.2
Texas:													
Gulf	35.9	34.4	38.0	37.3	37.9	36.2	40.8	40.8	43.4	44.2	44.9	45.7	479.5
East Texas	23.5	22.3	25.4	26.9	27.8	26.1	28.8	28.9	28.5	28.2	26.1	25.8	318.3
Panhandle	34.7	30.8	37.0	36.1	37.6	35.5	31.5	32.5	33.8	36.6	36.4	36.8	419.3
Rest of State	37.6	33.7	37.4	35.0	36.6	36.2	36.8	37.7	39.6	41.3	40.2	40.9	453.0
Total Texas	131.7	121.2	137.8	135.3	139.9	134.0	137.9	139.9	145.3	150.3	147.6	149.2	1,670.1
Arkansas	3.2	3.3	3.4	3.4	4.9	5.0	5.5	5.5	5.6	5.7	5.2	5.3	56.0
Louisiana:													
Gulf	5.6	5.4	5.8	6.1	6.2	5.9	6.2	6.1	5.7	6.1	5.2	6.0	70.3
Inland	20.2	18.6	20.7	19.1	17.8	18.4	18.9	18.5	19.8	20.0	21.4	22.5	235.9
Total Louisiana	25.8	24.0	26.5	25.2	24.0	24.3	25.1	24.6	25.5	26.1	26.6	28.5	306.2
New Mexico	7.5	6.4	7.1	6.6	6.6	6.8	7.3	7.7	6.5	6.5	6.2	6.0	81.2
Montana	.4	.4	.4	.4	.4	.4	.3	.3	.3	.4	.4	.6	4.7
Colorado and Wyoming	2.9	2.8	2.9	2.9	2.7	2.5	2.6	2.8	2.7	3.0	3.0	3.2	34.0
California	55.3	50.5	56.5	56.5	59.0	58.0	60.4	60.8	58.4	59.9	58.3	59.7	693.3
Total United States	300.7	278.9	309.0	301.2	306.2	296.2	306.1	310.8	315.1	329.0	322.8	327.5	3,703.5
Daily average	9.7	10.0	10.0	10.0	9.9	9.9	9.9	10.0	10.5	10.6	10.8	10.6	10.1

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[1] Subject to revision.

crease from 87,445 thousand gallons in 1942 to 110,139 thousand in 1943. The total output of light products was moderately higher in all principal producing fields except Santa Fe Springs and Long Beach, which declined 6 and 4 percent, respectively. Kettleman Hills produced 143 million gallons, of which 96 million were reported as natural gasoline and 47 million as liquefied gases.

Louisiana.—Total production at natural-gasoline and cycle plants was only 3 percent larger in 1943 than in 1942, a small gain compared with other recent years. Output of natural gasoline dropped 27 percent, but cycle products and liquefied petroleum gases rose 7 and 70

Natural gasoline and allied products produced and natural gas treated in the United States in 1942–43, by States

State	Number of operators [1]	Natural gasoline		Cycle products		Liquefied petroleum gases		Natural gas treated		
									Average yield (gallons per M cu. ft.)	
		Thousands of gallons	Thousands of dollars	Thousands of gallons	Thousands of dollars	Thousands of gallons	Thousands of dollars	Millions of cu. ft.	Natural gasoline (including cycle products)	All light products
1942										
Arkansas	6	34, 033	1, 138			8, 644	92	25, 365	1. 34	1. 68
California	34	545, 881	22, 365			87, 445	2, 564	345, 191	1. 58	1. 83
Colorado	1	[2] 346	17					25	1. 96	
Illinois	20	66, 389	3, 252			72, 934	2, 000	25, 722	2. 58	5. 42
Kansas	9	68, 948	2, 373			12, 880	422	179, 710	. 38	. 46
Kentucky	4	8, 884	438			27, 798	681	35, 408	. 25	1. 04
Louisiana	16	105, 615	3, 688	148, 747	5, 121	41, 712	1, 504	247, 370	1. 03	1. 20
Michigan	2	2, 518	120					1, 418	1. 78	1. 78
Montana	1	2, 810	201			1, 707	96	11, 728	. 24	. 39
New Mexico	7	73, 862	2, 131			15, 302	267	108, 911	. 68	. 82
New York	1	15	1					4	3. 75	3. 75
Ohio	7	6, 975	389					39, 851	. 18	. 18
Oklahoma	43	336, 707	12, 655			108, 408	2, 853	202, 653	1. 66	2. 20
Pennsylvania	53	14, 876	712			418	37	46, 603	. 32	. 33
Texas	99	701, 784	24, 198	506, 117	19, 274	359, 929	6, 832	1, 372, 563	. 88	1. 14
Utah		775	39							
West Virginia	19	67, 987	2, 817			33, 841	1, 548	197, 643	. 34	. 52
Wyoming	5	32, 699	1, 636			2, 538	104	24, 235	1. 35	1. 45
	270	2, 071, 104	78, 170	654, 864	24, 395	773, 556	19, 000	2, 864, 400	. 95	1. 22
1943 [3]										
Arkansas	7	39, 737	1, 550			16, 244	179	(4)	(4)	(4)
California	31	583, 181	23, 910			110, 139	3, 524			
Colorado		174	9							
Illinois	18	71, 928	3, 884			112, 159	2, 580			
Kansas	9	69, 870	3, 284			14, 897	432			
Kentucky	4	10, 551	601			32, 666	850			
Louisiana	17	76, 804	3, 303	158, 540	6, 183	70, 854	2, 112			
Michigan	2	1, 293	63							
Montana	1	2, 748	180			1, 915	110			
New Mexico	7	72, 749	3, 783			8, 481	187			
New York	1	14	1							
Ohio	6	6, 473	337							
Oklahoma	43	307, 384	16, 291			114, 789	2, 755			
Pennsylvania	51	16, 982	883			451	40			
Texas	95	668, 272	30, 113	524, 254	21, 817	477, 604	11, 126			
West Virginia	22	66, 804	3, 207			31, 724	1, 967			
Wyoming	5	30, 780	1, 601			3, 057	138			
	264	2, 025, 744	93, 000	682, 794	28, 000	994, 980	26, 000	2, 900, 000	. 93	1. 28

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[1] A producer operating in more than 1 State is counted but once in arriving at total for United States.
[2] Largely drip.
[3] Subject to revision.
[4] Not available.

percent, respectively, continuing recent trends. Production in 1944 will be affected by the addition of the cycle plant at Erath, which began to operate in April. Its reported capacity is over 20 million gallons of light products per month.

Oklahoma.—Light-products output declined further in 1943 to 422.2 million gallons from 445.1 in 1942. A small gain in liquefied gases (6.4 million gallons) was accompanied by a material loss (29.3 million gallons) in natural-gasoline production. The total production in the Seminole and Osage districts increased, but Oklahoma City and the rest of the State produced 13 percent less in 1943 than in 1942.

Texas.—Production of 1,670.1 million gallons of light products in 1943 exceeded 1942 by 7 percent to set a new record. As in 1942, the output of natural gasoline declined (5 percent), but increases were reported in cycle products (4 percent) and liquefied gases (33 percent). A tendency to separate larger percentages of liquefied gases is evident at cycle plants as well as at natural-gasoline plants.

A large gain in output was again recorded in the Gulf Coast, where cycle plant-operations continue to expand. New plants of very large capacity in the Katy field, Fort Bend County, North Houston, Harris County, and Lake Creek, Montgomery County, augmented the 1943 supply. Production from East Texas and the Panhandle increased slightly, but output in other districts dropped.

Other States.—Illinois was conspicuous among other important producing States with an increase of 32 percent in light products in 1943, most of which was attributable to liquefied gases formerly wasted. Arkansas continued to process more of its surplus gas, with consequent growth in recovery of liquid hydrocarbons (31 percent) and a small amount of sulfur. New Mexico output fell 9 percent, according to reports, and West Virginia 3 percent, influenced by declining gas production from its leading field (Charleston).

POST-WAR PROSPECTS

The natural-gasoline industry depends generally for its raw materials on oil and gas producers and for its market on petroleum refiners. As its sources of supply have been relatively stable and secure, its habitually volatile course has been dominated by the needs and policies of refiners.

To forecast the probable status of the natural-gasoline industry in the years immediately following the war it is most important, therefore, to consider the magnitude of refinery demand for its several products and the prices that may be anticipated. Recent developments in refining, notably catalytic cracking, have augmented the supply of light products from crude petroleum. These are readily absorbed at present, chiefly by aviation gasoline, synthetic rubber, and special naphthas for varied purposes. Should these war activities be sharply curtailed without a compensating increase in civilian demand, refiners might for an appreciable period reduce drastically their takings of the products derived from natural gas.

This possibility is cause for concern among leaders in the natural-gasoline industry, some of whom are seeking means of minimizing their dependence on refineries. To this end, the following have been mentioned: An increase in production of finished products at field plants to be marketed independently, cooperative processing of liquids from groups of plants, cooperative marketing, and development of new products and markets.

The position of cycle plants particularly is strengthened by their ability to produce in quantity some finished products (chiefly motor fuel) more economically than do refineries. Therefore, if markets for unfinished "natural" products are curtailed, with attendant distress prices, cycle plants within their limited field probably could compete successfully with refineries for a share of the trade in finished products. Most of the smaller, independent, natural-gasoline plants may be forced to alter their past trade practices in order to survive.

The past 2 years have brought an immense increase in understanding by industry and the public of the value of natural gas and its components. The great potential benefits that could flow from this enlightenment may be realized through improved practices in natural-gas use and processing in oil fields. Gasoline plants may become primarily a profitable means of increasing the recovery of petroleum in many fields. To accomplish this on a broad scale, effective unitization of fields must be facilitated by law, and the usual contractual obligations between producers and plant operators will change fundamentally. Changes of this character would be accelerated by a tight supply situation in petroleum and, conversely, would be retarded by an abundant supply.

From the long-term point of view, expanding markets for this industry appear assured. Opportunities for growth are numerous and diverse, but other uses than motor fuel normally require only a minor part of total output.

DEMAND AND MOVEMENTS

The demand for all light products, including liquefied refinery gas (sold for fuel) and benzol, increased in 1943 to 3,979,038 thousand gallons from 3,827,040 thousand in 1942.

Use of natural gasoline declined, as did sales of liquefied refinery gases for fuel. The major increase was in use of liquefied petroleum gases at refineries and for fuel outside the industry. Increased refinery demand for cycle condensate developed because of the great utility of this product in expanding aviation-gasoline production. As a result, jobbers distributed less condensate in 1943. Of the total demand for light products, refineries represented 65 percent in 1943 and 62 percent in 1942.

Refinery utilization.—The importance of natural gasoline and allied products to refinery-gasoline production has increased notably during the war period. In 1943 these materials composed 10.3 percent of the total gasoline output of refineries compared with 9.6 percent in 1942.

The adjacent table shows that expansion of significant proportions in refinery use of these products is limited to the Texas-Louisiana-Arkansas region and Illinois-Indiana. These are the areas in which rapid strides in light-products production have recently been made. Therefore, a strong tendency is evident for refineries to absorb locally the increments to light-product output, of which a small fraction only is transported long distances for refinery utilization.

"Direct" sales.—The quantity of natural gasoline and cycle condensate available to jobbers and others for outside consumption was less in 1943 than in 1942, probably influenced by the urgency of re-

Distribution of natural gasoline and allied products in the United States, 1942–43, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1942													
Production:													
Natural gasoline	179, 592	168, 504	172, 746	161, 112	170, 100	163, 380	171, 192	173, 796	174, 216	180, 348	176, 358	179, 760	2, 071, 104
Cycle products	61, 236	54, 558	59, 220	47, 628	53, 634	51, 156	53, 382	54, 810	53, 508	55, 440	54, 390	55, 902	654, 864
Liquefied petroleum gases	75, 138	62, 622	64, 344	52, 290	56, 700	59, 136	59, 430	64, 848	64, 890	67, 830	68, 040	78, 288	773, 556
Liquefied refinery gases	19, 824	17, 514	19, 782	20, 118	21, 798	21, 042	20, 622	18, 606	17, 010	13, 272	17, 094	20, 160	226, 842
Benzol	8, 736	7, 938	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	100, 674
Decrease in all stocks	-	-	-	-	-	3, 570	-	7, 518	13, 860	27, 762	17, 262	14, 574	-
	344, 526	311, 136	324, 492	289, 548	310, 632	306, 684	313, 026	327, 978	331, 884	353, 052	341, 544	357, 084	3, 827, 040
Used at refineries [1]	224, 742	183, 204	178, 668	166, 572	179, 424	185, 766	192, 234	206, 178	214, 536	229, 110	209, 538	207, 018	2, 376, 990
Sales of natural gasoline and cycle condensate to jobbers and retail outlets	14, 910	32, 382	42, 882	37, 548	37, 842	38, 724	35, 322	37, 716	33, 138	31, 164	36, 540	37, 632	415, 800
Sales for fuel purposes:													
Liquefied petroleum gases	29, 820	24, 234	23, 352	24, 024	20, 286	20, 916	22, 512	21, 084	24, 318	27, 846	28, 854	34, 944	302, 190
Liquefied refinery gases	19, 824	16, 590	20, 160	18, 690	19, 152	22, 470	21, 420	18, 438	16, 212	14, 490	16, 380	19, 446	223, 272
Increase in all stocks	15, 330	18, 018	16, 884	19, 194	24, 696	-	2, 184	-	-	-	-	-	11, 760
Exports, losses, and unidentified uses	39, 900	36, 708	42, 546	23, 520	29, 232	38, 808	39, 354	44, 562	43, 680	50, 442	50, 232	58, 044	[2] 497, 028
	344, 526	311, 136	324, 492	289, 548	310, 632	306, 684	313, 026	327, 978	331, 884	353, 052	341, 544	357, 084	3, 827. 040
1943 [3]													
Production:													
Natural gasoline	157, 332	147, 924	161, 574	162, 792	168, 966	164, 892	176, 190	183, 036	176, 190	180, 432	173, 334	173, 082	2, 025, 744
Cycle products	58, 800	53, 550	59, 010	54, 096	53, 634	51, 870	55, 146	54, 726	59, 136	60, 396	59, 934	62, 496	682, 794
Liquefied petroleum gases	84, 588	77, 406	88, 410	84, 294	83, 580	79, 422	74, 718	73, 080	79, 758	88, 200	89, 586	91, 938	994, 980
Liquefied refinery gases [4]	14, 070	14, 616	15, 288	14, 364	14, 196	12, 054	16, 674	13, 692	13, 944	11, 004	13, 818	17, 178	170, 898
Benzol	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	8, 400	100, 800
Decrease in stocks	-	-	-	1, 554	756	9, 576	6, 342	5, 670	7, 140	10, 836	-	4, 368	3, 822
	323, 190	301, 896	332, 682	325, 500	329, 532	326, 214	337, 470	338, 604	344, 568	359, 268	345, 072	357, 462	3, 979, 038
Used at refineries [1]	181, 314	181, 692	206, 094	209, 412	218, 274	213, 738	216, 762	230, 706	235, 746	233, 688	216, 972	225, 918	2, 570, 316
Sales of natural gasoline and cycle condensate to jobbers and retail outlets	35, 826	21, 924	24, 108	23, 730	24, 276	22, 512	22, 638	20, 706	23, 478	24, 906	23, 940	24, 108	292, 152
Sales for fuel purposes:													
Liquefied petroleum gases	34, 608	34, 818	37, 338	31, 710	28, 434	29, 862	29, 190	32, 508	31, 752	36, 792	39, 144	41, 202	407, 358
Liquefied refinery gases	14, 070	14, 616	15, 288	14, 364	14, 196	12, 054	16, 674	13, 692	13, 944	11, 004	13, 818	17, 178	170, 898
Transfers of cycle products	4, 536	4, 368	4, 578	6, 090	6, 090	5, 754	4, 536	4, 788	5, 586	6, 888	6, 216	6, 678	66, 108
Increase in stocks	11, 424	3, 864	19, 572	-	-	-	-	-	-	-	7, 560	-	-
Exports, losses, and unidentified uses	41, 412	40, 614	25, 704	40, 194	38, 262	42, 294	47, 670	36, 204	34, 062	45, 990	37, 422	42, 378	[5] 472, 206
	323, 190	301, 896	332, 682	325, 500	329, 532	326, 214	337, 470	338, 604	344, 568	359, 268	345, 072	357, 462	3, 979, 038

[1] Includes quantities run through pipe lines.
[2] Includes 53,038,000 gallons of liquefied gases used in chemical manufacturing.
[3] Subject to revision.
[4] The quantity of liquefied refinery gases used for fuel is shown as the amount produced.
[5] Includes approximately 55,000,000 gallons of liquefied gases used in chemical manufacturing.

Natural gasoline and allied products utilized at refineries in the United States, 1942–43, by districts and months, in thousands of gallons

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1942													
East Coast	7,476	5,502	3,360	2,772	1,134	2,100	2,856	3,318	2.856	1,764	2,226	1,218	36,582
Appalachian	2,352	1,764	1,722	1,596	1,554	1,596	2,100	1,344	1,512	1,974	2,268	1,680	21,462
Indiana, Illinois, Kentucky, etc	24,276	22,302	22,344	20,118	23,142	26,754	27,972	31,248	33,264	32,340	27,804	27,006	318,570
Oklahoma, Kansas, and Missouri	15,834	15,624	13,818	12,600	12,306	12,642	12,096	12,852	14,952	16,338	17,598	15,372	172,032
Texas:													
Gulf Coast	83,538	54,810	53,298	54,558	56,910	58,422	56,826	67,074	65,688	66,822	63,546	66,066	747,558
Inland	29,022	29,232	21,462	16,296	19,824	18,984	20,706	21,336	21,882	25,536	22,806	18,018	265.104
Total Texas	112,560	84,042	74,760	70 854	76,734	77,406	77,532	88,410	87,570	92,358	86,352	84,084	1,012,662
Louisiana-Arkansas:													
Louisiana Gulf Coast	8,274	4,662	9,282	8,820	9,996	11,760	11,214	8,148	10,668	16,086	13,440	14,700	127,050
Arkansas and Louisiana Inland	4,956	3,150	2,730	2,814	4,116	4,158	6,636	6,090	6,762	6,552	4,956	4,998	57,918
Total Louisiana-Arkansas	13,230	7,812	12,012	11,634	14,112	15,918	17,850	14,238	17,430	22,638	18,396	19,698	184,968
Rocky Mountain	3,948	3,066	2,688	1,764	1,092	1,302	1,680	2,016	2,268	4,200	4,788	4,662	33,474
California	45,066	43,092	47,964	45,234	49,350	48,048	50,148	52,752	54,684	57,498	50,106	53,298	597,240
Total United States	224,742	183,204	178,668	166,572	179,424	185,766	192,234	206,178	214,536	229,110	209,538	207,018	2,376,990
1943 [1]													
East Coast	3,612	1,050	3,444	2,520	1,722	294	4,158	5,628	336	1,302	1,428	5,166	30,660
Appalachian	1,806	1,722	1,680	1,470	1,176	1,218	1,260	1,176	1,554	1,806	1,428	1,764	18,060
Indiana, Illinois, Kentucky, etc	21,504	27,468	21,504	24,906	27,258	23,898	25,242	28,056	31,038	29,778	26,754	27,594	315,000
Oklahoma, Kansas, and Missouri	14,742	18,186	16,128	17,682	15,750	17,514	17,262	18,480	17,976	20,328	20,706	22,344	217,098
Texas:													
Gulf Coast	58,086	49,098	71,988	68,964	73,500	68,376	67,326	67,788	70,896	69,216	63,504	66,738	795,480
Inland	18,186	29,190	28,350	29,568	28,014	35,238	29,022	33,054	35,448	33,726	30,576	30,450	360,822
Total Texas	76,272	78,288	100,338	98,532	101,514	103,614	96,348	100,842	106,344	102,942	94,080	97,188	1,156,302
Louisiana-Arkansas:													
Louisiana Gulf Coast	14,406	12,684	12,474	12,432	12,474	14,154	16,632	15,330	15,246	16,128	15,876	13,902	171,738
Arkansas and Louisiana Inland	5,250	4,158	4,032	5,418	4,158	4,326	5,418	4,956	4,956	4,536	4,410	5,418	57,036
Total Louisiana-Arkansas	19,656	16,842	16,506	17,850	16,632	18,480	22,050	20,286	20,202	20,664	20,286	19,320	228,774
Rocky Mountain	3,402	2,898	2,058	1,638	1,302	1,344	1,302	1,092	2,310	4,032	4,074	2,520	27,972
California	40,320	35,238	44,436	44,814	52,920	47,376	49,140	55,146	55,986	52,836	48,216	50,022	576,450
Total United States	181,314	181,692	206,094	209,412	218,274	213,738	216,762	230,706	235,746	233,688	216,972	225,918	2,570,316

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[1] Subject to revision.

finery demand for these products. Sales of liquefied petroleum gases to distributors for fuel, however, increased a comparable amount, so total sales of light products through these trade outlets did not change greatly in 1943 from 1942.

Percentage of natural gasoline and allied products in refinery gasoline in the United States, 1939–43, by districts

Year	East Coast	Appalachian	Indiana, Illinois, Kentucky	Oklahoma, Kansas, Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas and Louisiana Inland	Rocky Mountain	California	Total
1939	2.7	1.4	4.1	7.8	14.3	3.5	2.1	5.0	4.7	18.0	6.6
1940	2.0	1.6	4.5	8.0	16.6	4.4	1.7	3.3	4.5	15.7	6.6
1941	2.3	1.9	5.3	6.6	17.6	5.6	3.7	6.1	4.4	16.1	7.1
1942 [1]	1.4	2.1	5.8	6.3	16.0	13.9	13.1	11.6	4.8	16.7	9.6
1943 [1] [2]	1.1	1.9	6.0	8.6	21.2	14.2	18.3	12.9	4.0	15.0	10.3

[1] Not comparable with prior years because relatively more liquefied petroleum gas is included.

[2] Subject to revision.

Exports.—Publication of separate export data for natural gasoline and allied products was discontinued after the review of 1940, when 71,526 thousand gallons were shipped to foreign countries. During the war this movement has been severely restricted by widespread dislocation of international trade and by the urgent domestic need for these materials in the manufacture of aviation gasoline and other petroleum products required in our war economy.

The following summarizes the principal export items for the latest 3 years, in thousands of gallons. The 1941 total was 53,886, of which 45,074 went to Canada, 4,471 to Mexico, 3,244 to the United Kingdom, and 127 to Portugal. The 1942 total was 57,414, of which 45,407 went to Canada, 4,574 to Mexico, 5,744 to the United Kingdom, and 114 to Portugal. The 1943 total was only 35,154, of which 27,828 went to Canada, 6,122 to Mexico, and 54 to Portugal.

STOCKS

Total stocks of light products originating at natural-gasoline and cycle plants (194,544 thousand gallons on January 1, 1943) increased to a peak of 229,404 on March 31 and subsequently declined to end the year at 190,722. After the first quarter, refinery demand expanded more rapidly than production of these products and was the chief cause of the reversal in stock trend.

Refinery stocks gained 23 million gallons in 1943, and those at plants and terminals decreased 27 million. Following an abrupt decline in 1942, California stocks increased 12 million gallons in 1943. The largest net withdrawal from stocks occurred in Texas and Oklahoma.

Stocks of natural gasoline declined 27 million gallons (17 percent) during 1943, cycle products increased 2 million (13 percent), and liquefied petroleum gases increased 21 million (90 percent). These trends in stocks have persisted for over 2 years. Natural-gasoline stocks have declined since August 1940 when they totaled 323,484 thousand gallons. Most of the large stock increase of L. P. G. in 1943 was accumulated at refineries.

Stocks of natural gasoline and allied products in the United States in 1943, by months, in thousands of gallons [1]

Date	Natural gasoline	Cycle products	Liquefied petroleum gases	Total
Jan. 1	157, 374	13, 524	23, 646	194, 544
Jan. 31	167, 244	15, 876	22, 848	205, 968
Feb. 28	167, 748	17, 640	24, 444	209, 832
Mar. 31	178, 164	18, 648	32, 592	229, 404
Apr. 30	174, 594	16, 086	37, 170	227, 850
May 31	173, 964	16, 548	36, 582	227, 094
June 30	168, 126	16, 548	32, 844	217, 518
July 31	160, 566	17, 892	32, 718	211, 176
Aug. 31	153, 384	13, 818	38, 304	205, 506
Sept. 30	139, 944	15, 918	42, 504	198, 366
Oct. 31	127, 470	14, 994	45, 066	187, 530
Nov. 30	132, 006	14, 994	48, 090	195, 090
Dec. 31	130, 410	15, 288	45, 024	190, 722

[1] Liquefied refinery gases have been omitted due to the difficulty of segregating stocks for fuel from those for other uses.

TECHNOLOGIC DEVELOPMENTS

Cycling plants.—Two large cycle plants were completed in Texas in 1943; one in California and one in Louisiana began operations early in 1944. Louisiana cycle plants processed about 71 billion cubic feet of natural gas in 1943, with an average yield of liquid products of over 2 gallons per thousand cubic feet. In Texas about 520 billion cubic feet were cycled, yielding 1.1 gallons of liquid hydrocarbons per thousand.

The demand for raw materials for aviation gasoline and synthetic rubber, particularly butanes, has prompted the installation of more equipment at cycle plants for separating a variety of special products and for increasing the recovery of the lighter fractions.

It has been demonstrated that absorption pressures above 2,000 pounds per square inch and injection pressures above 4,500 pounds are practicable in cycle operations; still higher operating pressures are anticipated in later plants, which will draw upon reservoirs at great depths.

Yields.—The average yield of natural gasoline and cycle products (except L. P. G.) declined in 1942 to 0.95 gallon per thousand cubic feet from 0.97 in 1941. Yields declined in nine States, including Texas, Oklahoma, and Louisiana. The total yield of light products per thousand cubic feet declined also from 1.23 in 1941 to 1.22 in 1942. In 1943 the estimated recovery of natural and cycle products continued to decline to 0.93, but the total of all products increased to 1.28, reflecting the emphasis placed upon production of lighter fractions.

Production by processes.—The number of operating gasoline plants continued to decline in 1942, a net loss of 15 being reported. Seventeen compression plants ceased production, chiefly in Illinois and Oklahoma, and 8 came "on stream" in other States. A reduction of 13 absorption-type plants in Texas, West Virginia, and other States was partly offset by the addition of 8 in Oklahoma and Illinois. Some of these changes are doubtless the result of conversion of plants from one type to another. Six new cycle plants began operating in 1942, the same number as was added in 1941.

Natural gasoline and allied products produced in the United States in 1942, by States and by methods of manufacture [1]

State	Number of plants operating				Production (thousands of gallons)			
	Compression [2]	Absorption [3] [4]	Charcoal	Cycling [5]	Compression [2]	Absorption [3] [4]	Charcoal	Cycling [5]
Arkansas		9				42,677		
California	3	87			2,058	631,268		
Colorado	1				49	[6] 297		
Illinois	35	7			1,649	137,674		
Kansas	2	12			1,632	80,196		
Kentucky	3	2			1,033	35,649		
Louisiana	3	25		2	2,897	133,638		159,539
Michigan	1	2			867	1,651		
Montana		1				4,517		
New Mexico	1	7			371	88,793		
New York	1				15			
Ohio	3	7	1		28	6,179	768	
Oklahoma	25	87			22,436	422,679		
Pennsylvania	66	11	1		1,804	13,470	20	
Texas	35	113		34	124,831	898,870		544,129
Utah						[6] 775		
West Virginia	52	19	3		22,725	76,951	2,152	
Wyoming	3	3			22,397	12,840		
Total: 1942	234	392	5	36	204,792	2,588,124	2,940	703,668
1941	243	397	6	30	255,150	2,644,824	4,872	491,064

[1] Figures for 1943 not yet available.
[2] Includes 16 plants manufacturing liquefied petroleum gases.
[3] Includes combination of absorption process with compression and charcoal processes.
[4] Includes 162 plants manufacturing liquefied petroleum gases.
[5] Includes 13 plants manufacturing liquefied petroleum gases.
[6] Drip gasoline.

The proportion of total liquid production at plants contributed by the several methods in 1942 was as follows: Absorption 74 percent, compression almost 6 percent, cycle 20 percent, and charcoal 0.08 percent. Comparable figures for 1939, based upon production of natural gasoline and cycle condensate only, were: Absorption almost 88 percent, compression (including a small cycle output) 12 percent, and charcoal 0.3 percent.

Vapor pressures.—The average vapor pressure of natural gasoline produced east of California was 21.2 pounds in 1943 and 20.5 in 1942.

Technical trends.—In response to greatly enlarged demands for isobutane, isopentane, and butylene, emphasis was placed on adjusting processing equipment, particularly at large plants, to separate these products or mixtures containing a concentration of them. Plant operations were adapted more closely than ever before to refinery requirements in the interest of maximum efficiency.

Concentrated research effort is continuously producing new techniques and products and new applications for products that have been in commercial use for years. Hence rapid change characterizes many phases of the industry.

LIQUEFIED PETROLEUM GASES

The rate of expansion in sales of liquefied petroleum gases shrank further in 1943, when delivereies of 675,233,000 gallons were only 15 percent above the 1942 total of 585,440,000, compared with increases of 27 percent in 1942 and 48 percent in 1941. Adverse market factors, evident in 1941 and 1942—such as inadequate transportation, shortage of equipment for handling and use, and diversion of increasing quantities for consumption as raw material principally for the manufacture of rubber and high-octane motor fuel—were intensified further in 1943 and prevented distributors from supplying the potential demand in full.

Sales of liquefied petroleum gases in the United States, 1936–43, in thousands of gallons

Year	Butane	Propane	Butane-propane mixtures	Pentane	Total	
					Quantity	Percent of increase over preceding year
1936	40, 200	36, 502	27, 375	2, 575	106, 652	38. 8
1937	45, 399	46, 474	46, 694	2, 833	141, 400	32. 6
1938	52, 768	54, 130	56, 050	2, 253	165, 201	16. 8
1939	71, 351	79, 323	69, 020	3, 886	223, 580	35. 3
1940	77, 056	109, 216	123, 348	3, 836	313, 456	40. 2
1941	112, 244	126, 969	219, 252	4, 387	462, 852	47. 7
1942	128, 560	150, 511	301, 917	4, 452	585, 440	26. 5
1943 [1]	140, 122	218, 273	312, 683	4, 155	675, 233	15. 3

[1] Subject to revision.

The respective percentage increases for the principal uses of liquefied petroleum gases varied widely in 1943 compared with 1942. Sales of liquefied petroleum gases for industrial fuel made a greater percentage gain in 1943 than in 1942, but increases for other uses in 1943 (except the minor "all other uses") were below the 1942 rate. Deliveries of liquefied petroleum gases to industrial plants increased 31 percent in 1943 (149,429,000 gallons in 1943 compared with 114,132,000 in 1942) or double the 16-percent gain reported for 1942. The volume of liquefied petroleum gases credited to gas-manufacturing companies (37,519,000 gallons in 1943) was 20 percent above the 1942 total of 31,366,000 gallons—an increment that compares with a 24-percent expansion in 1942. The annual growth in sales of liquefied petroleum gases for domestic use has contracted sharply from a 65-percent gain in 1941 to 36 percent in 1942 and only 13 percent in 1943, owing to supply, equipment, and transportation difficulties. Reported deliveries of liquefied petroleum gases for domestic fuel were 339,380,000 gallons in 1943 against 299,559,000 in 1942. Limited supplies and restrictions in some areas are reflected in the smaller increase in use of liquefied petroleum gases as fuel for internal-combustion engines—87,834,000 gallons in 1943 compared with 82,456,000 in 1942—a 7-percent gain in contrast with a 23-percent expansion in 1942 over 1941. Purchases by chemical plants of liquefied petroleum gases for raw material—55,356,000 gallons in 1943—were only 4 percent above 1942 requirements and compare with a 20-percent gain in this particular demand recorded for 1942.

The percentage shares of the different gases making up total sales of liquefied petroleum gases changed somewhat in 1943 compared with 1942. Liquefied gases reported as butane dropped from 22 percent of the total in 1942 to 21 percent in 1943, as relatively more butane was diverted for raw material to manufacturers of motor fuel and rubber. The propane item for 1943 increased to 32 percent of total sales compared with 26 percent in 1942, a gain reflecting a shift from butane and butane-propane mixtures to propane as an industrial fuel. The rise in the propane proportion of total sales of liquefied petroleum gases was counterbalanced by a similar percentage loss for butane-propane mixtures, as "mixtures" dropped from 52 percent of 1942 deliveries to 46 percent in 1943. Pentane made up less than 1 percent of the 1943 total or about the same proportion as in recent years.

The rising demand for butane for use as raw material is indicated in the declining rate of increase in sales for fuel purposes. Deliveries of butane in 1943—140,122,000 gallons—were 9 percent above the 1942 total of 128,560,000—a gain compared with increments of 15 percent in 1942 and 46 percent in 1941. Equipment for handling butane was not restricted to industrial and chemical plants and established gas-manufacturing companies; consequently sales of butane to such establishments gained in 1943 over 1942. Domestic users could not obtain new equipment for the consumption of butane, and its diversion for use as motor fuel was greatly restricted, so deliveries of butane under these two headings declined in 1943. Gas companies using butane as "stand-by" gas purchased 21,829,000 gallons of butane in 1943, a 76-percent gain over the 1942 quantity of 12,419,000 gallons. It is believed that part of this rise in the use of butane reflects the effort of gas companies to supply communities expanding under war conditions. The use of butane as industrial fuel, which comprises about 40 percent of the total, increased 11 percent from 50,495,000 gallons in 1942 to 56,143,000 in 1943. Chemical plants do not use relatively large quantities of butane as raw material; however, their purchases of 7,972,000 gallons in 1943 were 52 percent above the 1942 total. The use of butane as motor fuel has declined from 18,799,000 gallons in 1941 to 14,870,000 in 1942 and to 9,895,000 in 1943.

A shift to propane for fuel purposes to release butane for raw material is evident in a 45-percent increase in propane sales in 1943—218,273,000 gallons in 1943 and 150,511,000 in 1942—compared with a 19-percent expansion in 1942 over 1941. The totals for all principal uses of propane were larger in 1943 than in 1942, except purchases by chemical companies, which declined. Propane is still predominantly a domestic fuel; however, the proportion of total deliveries reported for domestic use has dropped from 77 percent of the total in 1941 to 75 percent in 1942 and down to 57 percent in 1943. The declining rate of growth in the use of propane for domestic purposes under adverse war conditions is indicated in another way, namely, the smaller percentage gains in sales in recent years—42 percent in 1941, 16 percent in 1942, and 10 percent in 1943. Gas companies do not buy relatively large quantities of propane; however, their purchases increased from 4,957,000 gallons in 1942 to 8,117,000 in 1943—a 64-percent gain contrasted with a 26-percent decline in 1942 compared with 1941 requirements. Propane used as an industrial fuel increased by nearly threefold in 1943 as manufacturers turned to this more available gas in place of butane. Deliveries of propane to industrial plants (73,698,000 gallons in 1943) were 258 percent above the 1942 total of 20,601,000 gallons. Furthermore, the volume of propane reported sold as industrial fuel was above the butane total for the first time in 1943. The quantity of propane used as raw material by chemical plants is not currently important, and the total declined to 4,455,000 gallons in 1943 compared with 5,850,000 gallons in 1942. Increasing sales of propane for internal-combustion-engine fuel has been reported in recent years as the supply of butane has been shifted to other uses. Propane credited as motor fuel has expanded from 1,631,000 gallons in 1941 to 3,112,000 in 1942 and to 4,592,000 in 1943.

Sales of butane-propane mixtures (312,683,000 gallons in 1943) were only slightly above the 1942 total of 301,917,000 gallons. The annual percentage expansion in butane-propane deliveries, similarly to butane, has diminished noticeably in recent years, shrinking from a 78-percent gain in 1941 over 1940 to a 38-percent gain in 1942 and down to an increment of only 4 percent in 1943. Sales of butane mixtures for domestic use increased by 21 percent from 140,516,000 gallons in 1942 to 169,818,000 in 1943. Butane-propane mixtures, like propane, are predominantly domestic fuels; however, the proportion of the total reported for domestic use is expanding for "mixtures," but for propane relatively smaller quantities of the total are going for household consumption. Forty percent of the butane-propane mixtures were delivered for domestic fuel in 1941, 47 percent in 1942, and 54 percent in 1943. Gas-manufacturing companies bought substantially more butane and propane in 1943 but less of the "mixtures," the quantity of the latter declining by 46 percent from 13,961,000 gallons in 1942 to 7,532,000 in 1943. The strong industrial turn to propane for fuel under present conditions is the opposite from the pronounced drop in deliveries of butane-propane mixtures for this purpose, the quantity shrinking by 55 percent from 43,011,000 gallons in 1942 to 19,474,000 in 1943. Large amounts of butane-propane mixtures are used as raw material by chemical plants; however, their requirements have remained fairly constant for several years—39,243,000 gallons in 1941, 38,325,000 in 1942, and 39,584,000 in 1943. As supplies of butane have tightened because of diversion to other channels, the use of butane-propane mixtures for internal-combustion-engine fuel has mounted steadily; the 1943 total of 73,344,000 gallons is 14 percent above the 1942 demand of 64,470,000 gallons.

Sales of pentane, which are relatively unimportant in volume, declined 7 percent from 4,452,000 gallons in 1942 to 4,155,000 in 1943. Most of the pentane is delivered to chemical plants for use as raw material—the quantity declined from 3,607,000 gallons in 1942 to 3,345,000 in 1943. Some pentane is consumed as domestic fuel; however, the total has diminished from 1,128,000 gallons in 1941 to 766,000 in 1942 and to 637,000 in 1943.

Unusual factors under the stress of war conditions have forced some changes in the proportions of the various gases sold for principal uses. Butane, which made up about 16 percent of the domestic demand item in 1940, has gradually decreased to a 13-percent share of the total in 1943. Propane as a domestic fuel had been replaced by butane-propane mixtures to some extent. Propane delivered as domestic fuel, making up over 50 percent of the total demand in 1940, constituted only 37 percent of the domestic-use item in 1943, but "mixtures" have expanded from one-third of the domestic total in 1940 to one half in 1943. Purchases of butane by gas companies dropped from 54 percent of their requirements in 1940 to 40 percent in 1942.

Sales of liquefied petroleum gases in the United States, 1942–43, by uses, methods of transportation, and regional distribution, in thousands of gallons

	Butane	Propane	Butane-propane mixtures	Pentane	Total	
					Quantity	Percent
1942						
By uses:						
Domestic	45,028	113,249	140,516	766	299,559	51.2
Gas manufacturing	12,419	4,957	13,961	29	31,366	5.3
Industrial fuel	50,495	20,601	43,011	25	114,132	19.5
Chemical manufacturing	5,256	5,850	38,325	3,607	53,038	9.1
Internal-combustion-engine fuel	14,870	3,112	64,470	4	82,456	14.1
All other uses	492	2,742	1,634	21	4,889	.8
	128,560	150,511	301,917	4,452	585,440	100.0
Percent of total	21.9	25.7	51.6	0.8	100.0	
By methods of transportation:						
Bulk	127,492	88,340	297,511	4,161	517,504	88.4
Cylinders and drums	1,068	62,171	4,406	291	67,936	11.6
	128,560	150,511	301,917	4,452	585,440	100.0
Regional distribution:						
Pacific Coast area	10,044	17,803	99,058		126,905	21.7
All other areas	118,516	132,708	202,859	4,452	458,535	78.3
	128,560	150,511	301,917	4,452	585,440	100.0
1943 [1]						
By uses:						
Domestic	44,255	124,670	169,818	637	339,380	50.3
Gas manufacturing	21,829	8,117	7,532	41	37,519	5.6
Industrial fuel	56,143	73,698	19,474	114	149,429	22.1
Chemical manufacturing	7,972	4,455	39,584	3,345	55,356	8.2
Internal-combustion-engine fuel	9,895	4,592	73,344	3	87,834	13.0
All other uses	28	2,741	2,931	15	5,715	.8
	140,122	218,273	312,683	4,155	675,233	100.0
Percent of total	20.8	32.3	46.3	.6	100.0	
By methods of transportation:						
Bulk	139,454	148,453	307,566	3,990	599,463	88.8
Cylinders and drums	668	69,820	5,117	165	75,770	11.2
	140,122	218,273	312,683	4,155	675,233	100.0
Regional distribution:						
Pacific Coast area	10,268	25,863	100,470		136,601	20.2
All other areas	129,854	192,410	212,213	4,155	538,632	79.8
	140,122	218,273	312,683	4,155	675,233	100.0

[1] Subject to revision.

However, this trend was reversed in 1943, when the proportion of butane in gas companies' purchases jumped to 58 percent. The propane share in the liquefied petroleum gases credited to gas companies also followed a trend similar to that of butane, dropping from 26 percent of the total in 1940 to 16 percent in 1942 and then rising to 22 percent in 1943. Sales of butane-propane mixtures to gas companies followed a reverse pattern from that of butane and propane, increasing from 21 percent of total requirements in 1940 to 45 percent in 1942 and then shrinking to 20 percent of the gas-company item in 1943, as this industry turned strongly to butane and propane for "stand-by" gas.

Butane, with its higher B. t. u. content, is the better fuel for industrial use, but manufacturers have had to turn to propane under current conditions. Butane constituted about 47 percent of the liquefied-petroleum-gas requirements of manufacturing plants in 1940 and 1941, 44 percent in 1942, and 38 percent of the total in 1943. The propane share in the industrial-fuel total has fluctuated irregularly from 47 percent in 1940 to 17 percent in 1941 and 18 percent in 1942, followed by a strong upward turn to 49 percent of the total for 1943, as manufacturers bought more than three times as much propane as was reported for 1942. The percentage of butane-propane mixtures in sales of liquefied petroleum gases to industrial establishments, like that for propane, has changed greatly in recent years, constituting 5 percent of the total in 1940, 36 percent in 1941, and 38 percent in 1942, and then dropping to 13 percent of total industrial-fuel requirements in 1943.

Butane-propane mixtures comprise the larger share of liquefied petroleum gases used by chemical plants as raw material, the proportion being about 88 percent of their purchases in 1940 and 1941 and then a shrinkage to 72 percent of the total in 1942 and 1943, as manufacturers of chemicals increased their purchases of butane and propane. Most of the pentane is reported as raw material for chemical plants, and this gas has ranged from 9 percent of the chemical "item" in 1940 to 6 percent in 1943. Butane-propane mixtures are used more than the straight butane and propane as fuel for internal-combustion engines and satisfied about 77 percent of the demand in 1940, 70 percent in 1941, 78 percent in 1942, and 84 percent of the motor-fuel total in 1943. Butane for engine fuel has declined from 28 percent of the 1941 requirements to 11 percent in 1943, as restrictions on its use were put in force. Propane is not used in important volume as a fuel for internal-combustion engines.

The American Gas Association has cooperated with the Bureau of Mines by supplying the following information concerning the distribution of liquefied petroleum gases by manufactured-gas companies in 1943:

> At the end of 1943, liquefied petroleum gas was being delivered through mains to consumers in 219 communities in 32 States by 101 companies supplying 83,320 consumers.
>
> Butane-air gas with heating value ranging from 520 to 1,300 B. t. u. per cubic foot was supplied to 157 communities in 30 States. A mixture of undiluted butane and propane gas with a heating value of 2,800 to 3,000 B. t. u. per cubic foot was supplied to 18 communities in Arizona, California, and New Mexico. Undiluted propane gas with a heating value of 2,550 B. t. u. per cubic foot was supplied to 41 communities in Maryland, Minnesota, Nevada, New Jersey, North Dakota, Virginia, and Wisconsin.

The percentage of bulk shipments of liquefied petroleum gases has tended to increase slightly in recent years as cylinders or other small containers have become difficult to obtain. Liquefied petroleum gases handled in bulk totaled 599,463,000 gallons in 1943 and constituted about 89 percent of all sales compared with 517,504,000 gallons in 1942, or 88 percent of the annual total. Shipments of liquefied petroleum gases in cylinders increased from 67,936,000 gallons in 1942 to 75,770,000 in 1943.

Sales of liquefied petroleum gases in the Pacific coast area (California, Oregon, Washington, Arizona, and Nevada) increased 8 percent from 126,905,000 gallons in 1942 to 136,601,000 in 1943. The 1943 total for the Pacific coast represented 20 percent of the marketed production of liquefied petroleum gases in 1943 compared with a 22-percent share in 1942. Deliveries of liquefied petroleum gases reported for "all other areas" totaled 538,632,000 gallons in 1943, a gain of about 18 percent over the 1942 volume of 458,535,000 gallons.

CARBON BLACK

By F. S. Lott and H. Backus

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SUMMARY

The year 1943 was relatively satisfactory for the carbon-black industry. Sales recovered 40 percent from the 1942 slump (occasioned chiefly by severe dislocations in the rubber industry) and expanded rapidly in the fourth quarter of 1943 to levels greatly exceeding production. Hence a sharp decline in stocks of carbon blacks held by producers occurred late in 1943 and continued through the first quarter of 1944. Total production in 1943 was 3 percent above 1942, a decline of 11 percent in output of contact blacks having been offset by a 47-percent gain in the furnace types (see fig. 1).

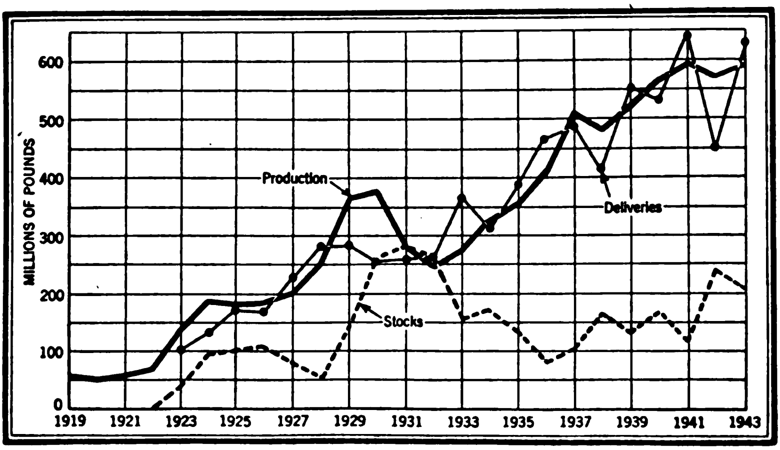

FIGURE 1.—Production, stocks, and deliveries of carbon black, 1919–43.

The rubber trade increased its purchases 60 percent in 1943 to the largest total on record and absorbed 90 percent of all domestic sales compared with 89 percent in 1942. The expanding output of synthetic rubber and products indicates that the rubber companies are emerging from the difficult transition period in 1942 and 1943 and may be expected to utilize larger quantities of carbon black for an extended period.

Exports declined moderately in 1943, as in other years since 1939, and were only 17 percent of total sales.

According to the Office of Price Administration, ceiling prices on all grades of carbon black remained unchanged in 1943.

Salient statistics of carbon black produced from natural gas in the United States, 1939–43

	1939	1940	1941	1942	1943
Number of producers reporting	22	22	21	21	21
Number of plants	49	51	49	50	54
Quantity produced:					
By States and districts:					
Louisiana pounds	51, 734, 000	55, 610, 000	78, 050, 000	90, 353, 000	109, 609, 000
Texas:					
Panhandle district do	410, 130, 000	423, 908, 000	415, 001, 000	380, 536, 000	345, 447, 000
Rest of State do	43, 044, 000	55, 987, 000	65, 211, 000	54, 353, 000	61, 898, 000
Total Texas do	453, 174, 000	479, 895, 000	480, 212, 000	434, 889, 000	407, 345, 000
Other States do	20, 258, 000	33, 287, 000	35, 803, 000	48, 764, 000	76, 467, 000
Total United States do	525, 166, 000	568, 792, 000	594, 065, 000	574, 006, 000	593, 421, 000
By processes:					
Contact processes [1] do	469, 150, 000	497, 026, 000	492, 857, 000	428, 665, 000	379, 923, 000
Furnace processes [2] do	56, 016, 000	71, 766, 000	101, 208, 000	145, 341, 000	213, 498, 000
Stocks held by producers Dec. 31 pounds	130, 792, 000	169, 587, 000	118, 847, 000	242, 755, 000	205, 215, 000
Losses do	....	223, 000	61, 000	167, 000	1, 661, 000
Quantity sold:					
Domestic deliveries—					
To rubber companies do	316, 621, 000	310, 179, 000	439, 502, 000	295, 947, 000	473, 473, 000
To ink companies do	21, 929, 000	24, 159, 000	28, 198, 000	19, 233, 000	23, 530, 000
To paint companies do	6, 382, 000	6, 806, 000	5, 840, 000	3, 616, 000	3, 945, 000
For miscellaneous purposes do	11, 773, 000	11, 012, 000	23, 039, 000	15, 500, 000	23, 440, 000
Total domestic deliveries do	356, 705, 000	352, 156, 000	496, 579, 000	334, 296, 000	524, 388, 000
Export do	203, 828, 000	177, 618, 000	148, 165, 000	115, 635, 000	104, 912, 000
Total sold do	560, 533, 000	529, 774, 000	644, 744, 000	449, 931, 000	629, 300, 000
Value (at plants) of carbon black produced:					
Total	$12, 857, 000	$16, 510, 000	$19, 341, 000	$19, 547, 000	$20, 248, 000
Average per pound cents	2. 45	2. 90	3. 26	3. 41	3. 41
Estimated quantity of natural gas used M cubic feet	347, 270, 000	368, 802, 000	365, 377, 000	335, 533, 000	315, 562, 000
Average yield of carbon black per M cubic feet pounds	1. 51	1. 54	1. 63	1. 71	1. 88
Average value of natural gas used per M cubic feet cents	. 94	1. 00	1. 13	1. 29	1. 47

[1] Principally channel.

[2] Includes furnace, thermatomic, and Lewis.

Summary of statistics for carbon black produced from natural gas in the United States, 1939–43

Year	Production (thousands of pounds)	Value (thousands of dollars)	Stocks at end of year (thousands of pounds)	Sales (thousands of pounds)		Average yield (pounds per M cubic feet of gas)
				Domestic	Export	
1939	525, 166	12, 857	130, 792	356, 705	203, 828	1. 51
1940	568, 792	16, 510	169, 587	352, 156	177, 618	1. 54
1941	594, 065	19, 341	118, 847	496, 579	148, 165	1. 63
1942	574, 006	19, 547	242, 755	334, 296	115, 635	1. 71
1943	593, 421	20, 248	205, 215	524, 388	104, 912	1. 88

WAR AND POST-WAR SITUATION

The close ties between carbon black and its chief market, the rubber industry, result from common interests of fundamental importance to each. When Japanese conquests compelled the rubber industry to find substitutes for its raw material, and quickly, the carbon-black industry was threatened with loss of its sustaining market unless its product could be adapted to the new conditions. Research by these and other industries into the nature of synthetic rubbers and their processing for varied uses was greatly expanded, with the cooperation of the War Production Board. Knowledge of carbon black in rubber compounds was limited generally to its effects, the specific causes of observed phenomena being unknown; therefore empirical methods were required to guide experiment and development of products. Coordination of the work of the many organizations involved in the program is accomplished through the War Production Board, which promptly disseminates test results and new knowledge to all directly concerned. In one phase of systematic testing, four automotive fleets are maintained to continuously subject tires to severe service tests.

The effects of the program upon carbon-black production are evident in the marked expansion in output of furnace types and of easy-processing channel blacks. The War Production Board estimates total requirements for furnace black of over 300 million pounds in 1944 and 400 million in 1945; and for channel black, about 650 million pounds in 1944 and 675 million in 1945.

It is generally believed that demand for carbon black will be very large for several years after the war, chiefly because a record consumption of rubber is anticipated. A revival of rubber processing abroad should stimulate exports, and the domestic rubber industry looks forward to tremendous tire demands for new vehicles and replacements. The new developments in plastics may create a substantial peacetime market for high-color contact blacks.

The great imponderable with respect to readjustment of the carbon-black industry to post-war conditions relates to the types of blacks which the market will favor; this problem is inseparable from the competitive aspects of natural rubber vs. synthetics in a normal economy. The latter situation involves the interplay of complex and often conflicting forces reflecting variable economic and technical factors and future national and international policies that defy definitive interpretation at present. Simple logic indicates that a great deal of natural rubber will be used in foreign countries and probably in the United States. Its importance relative to synthetics in the post-war world is highly speculative.

PRODUCTION

By States.—Because of a 9-percent reduction in output of the Panhandle and material gains in other States, Texas supplied only 69 percent of the United States total carbon-black production in 1943—the lowest proportion in recent years. Operations in the Texas Panhandle were restricted by a local gas-supply situation, upon which the provisions of Texas law (sweet-gas restrictions) and O. P. A. price ceilings for channel blacks have a bearing. A pipe line has been authorized to bring additional sour gas to channel plants.

War expansion continued in Louisiana, where 1943 output was raised 21 percent to the highest level since 1929. Furnace blacks have become the dominant types produced in Louisiana.

Increased output was reported in all other producing States, the gain in Oklahoma being 29 percent and in the California, Kansas, New Mexico group, 84 percent.

Carbon black produced from natural gas in the United States in 1943, by States and by major producing districts

State and district	Producers reporting[1]	Number of plants	Production			Natural gas used			
				Value at plant			Average yield per M cubic feet (pounds)	Value	
			Pounds	Total	Average (cents)	M cubic feet		Total	Average per M cubic feet (cents)
California	1	1	45,056,000	$1,134,000	2.52	11,329,000	3.98	$479,000	4.23
Kansas	2	3							
New Mexico	1	1							
Louisiana: Monroe-Richland and Southern districts	7	8	109,609,000	3,823,000	3.49	17,546,000	6.25	493,000	2.81
Oklahoma	4	4	31,411,000	1,036,000	3.30	6,022,000	5.22	137,000	2.27
Texas:									
Panhandle district	15	29	345,447,000	12,004,000	3.47	249,457,000	1.38	3,225,000	1.29
Rest of State	4	8	61,898,000	2,251,000	3.64	31,208,000	1.98	290,000	.93
Total Texas	16	37	407,345,000	14,255,000	3.50	280,665,000	1.45	3,515,000	1.25
Total United States	21	54	593,421,000	20,248,000	3.41	315,562,000	1.88	4,624,000	1.47

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[1] In counting the total number of producers reporting, a producer operating in more than 1 State, district, or county is counted but once.

Methods and yields.—The furnace blacks continued to advance in importance in response to demands of the synthetic rubber program and were 36 percent of total production in 1943, 25 in 1942, and 11 in 1939. Distribution of channel blacks was not controlled by the War Production Board in 1943, but furnace types were under allocation control throughout the year.

The average yield of all carbon blacks increased in 1943 to 1.88 pounds per thousand cubic feet of gas from 1.71 in 1942. All districts reported higher yields except the Texas Panhandle, where the channel process is generally used. The production of easy-processing black at channel plants has increased because of its utility in synthetic rubber processing to about 60 percent of the total channel output. Yields of this grade are about 20 percent lower than yields of the hard and medium grades; hence average yields of channel blacks have declined.

Number and capacity of plants.—At the end of 1943, 54 plants were operating compared with 50 a year earlier. Seven new furnace-type plants began production in the following locations: Kansas one, Louisiana two, Oklahoma one, and Texas three. Three channel plants were shut down or dismantled—one in Oklahoma, and two in Texas.

New facilities expanded the daily capacity of all plants in 1943 to 2,166,713 pounds, or 20 percent above the 1942 total of 1,808,756. The operating rate was about 75 percent of capacity in 1943 and 87 percent in 1942.

Producers.—The list of companies reporting carbon-black production did not change in 1943. Phillips Petroleum Co. is reported to have produced carbon black in 1943 at its Borger (Tex.) refinery by a new process utilizing liquid hydrocarbons as raw materials.

Carbon-black producers of the United States, as of Dec. 31, 1943

State and company	County or parish	Nearest town	Process
California: Shell Chemical Co	Contra Costa	Pittsburg	Furnace.
Kansas:			
Peerless Carbon Black Co	Grant	Ulysses	"Special."
United Carbon Co., Inc	do	Ryus	Roller.
	do	do	Furnace.
Louisiana:			
Cabot Carbon Co	Evangeline	Ville Platte	Do.
Columbian Carbon Co	Avoyelles	Eola	Do.
Imperial Oil & Gas Products Co	Ouachita	Sterlington	Channel.
Charles Eneu Johnson & Co	Morehouse	Bastrop	Do.
Peerless Carbon Black Co	Ouachita	Bourland	"Special."
Southern Carbon Co	do	Hancock	Lewis.
Thermatomic Carbon Co	do	Sterlington	Thermatomic.
United Carbon Co	do	Swartz	Channel.
New Mexico: Columbian Carbon Co	Lea	Eunice	Do.
Oklahoma:			
Cabot Carbon Co	Texas	Guymon	Furnace.
General Atlas Carbon Division of General Properties Co., Inc.	do	do	Do.
Charles Eneu Johnson & Co	Pontotoc	Stonewall	Channel.
United Carbon Co	Beckham	Sayre	Do.
Texas:			
Cabot Carbon Co	Carson	Skellytown	Roller and Channel.
	Gray	Pampa	Channel.
	Hutchinson	Stinnett	Do.
	Ward	Monahans	Do.
	Winkler	Kermit	Do.
Carbon Blacks, Inc	Gray	Lefors	Roller.
Coltexo Corporation	do	do	Channel.
Columbian Carbon Co	Carson [1]	(1)	(1).
	Gray	Kings Mill	Channel.
	do	Lefors	Do.
	Harris	Fortune	Furnace.
	Hutchinson	Borger (2 plants)[1]	Channel.
	Montgomery	Conroe	Furnace.
	Moore	Sunray	Channel.
	Neuces	Corpus Christi	Do.
Columbian-Phillips Co	Moore	Sunray	Do.
Combined Carbon Co	Hutchinson	Sanford	Do.
Continental Carbon Co	Moore	Sunray	Do.
Crescent Carbon Co	Hutchinson	Borger	Do.
Crown Carbon Co	Moore	Sunray	Do.
General Atlas Carbon Division of General Properties Co., Inc	Gray	Pampa	Furnace.
J. M. Huber Corporation	Hutchinson	Borger	Channel.
	do	do	Furnace.
Moore County Carbon Co	Moore	Sunray	Channel.
Panhandle Carbon Co	Hutchinson	Borger	Do.
Peerless Carbon Black Co	Gray	Pampa	"Special."
Texas Elf Carbon Co	do	do	Channel.
	Stephens	Eliasville	Do.
United Carbon Co	Aransas	Aransas Pass	Do.
	do	do	Furnace.
	Hutchinson	Borger (3 plants)	Channel.
	do	Sanford (2 plants)	Do.
	do	Stinnett	Do.
	Moore	Sunray	Do.

[1] Plant, located in both Carson and Hutchinson Counties, counted in Hutchinson County.

DEMAND

Total deliveries.—Total deliveries by producers in 1943 were 629,300,000 pounds, 40 percent more than in 1942. Requirements of all domestic consuming trades increased, but exports declined 9 percent from 1942.

Domestic demand.—Revival of demand, particularly from the rubber industry, caused a 57-percent gain in domestic deliveries by producers in 1943 to 524,388,000 pounds—a new record. Of this quantity, the rubber companies took 90 percent, ink companies 4.5

percent, paint companies 1 percent, and miscellaneous users 4.5 percent (see fig. 2).

Deliveries to the rubber industry in 1943 (473,473,000 pounds) were 60 percent greater than in 1942 and the highest on record. In the last quarter they approached a rate of 600 million pounds per year. Although the rise in demand for furnace blacks in synthetic rubber compounding has been spectacular, great quantities of easy processing channel black are also required. The latter type produces a rubber of tougher wearing qualities than any of the furnace blacks developed thus far. With synthetic rubber slightly more carbon black apparently is used per pound of total output than with natural rubber. Heavier loading with black gives better results for some purposes, and a lower percentage of zinc oxide is generally used. Many articles in varied colors formerly were made of natural rubber without the addition of carbon black. Synthetics, however, are practically useless without the addition of a filler, and their utilization by this section of the rubber trade has created a new outlet for carbon blacks, with a consequent dearth of bright-colored products for the duration of the war.

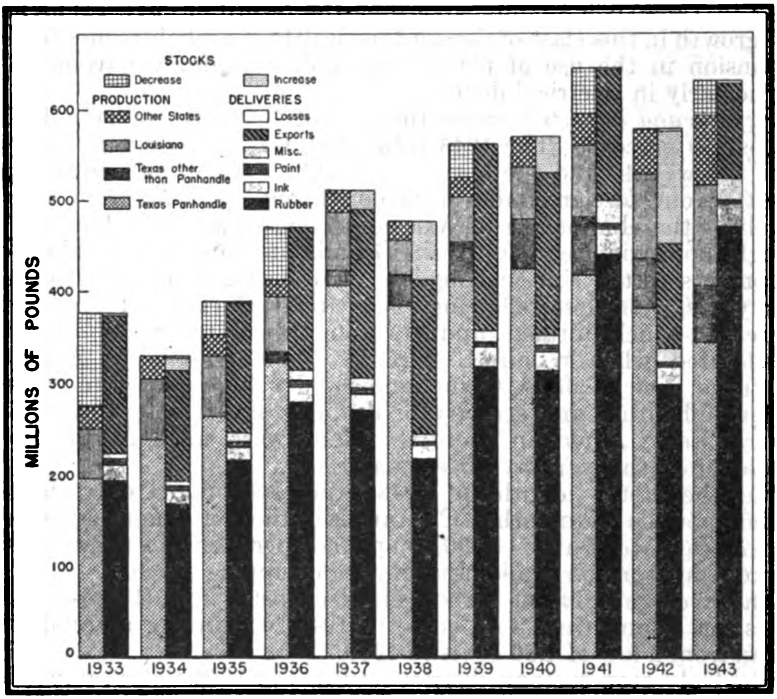

FIGURE 2.—Production and consumption of carbon black, 1933–43. Production in "Texas other than Panhandle" included in "Other States," 1933–35.

Ink companies purchased 23,530,000 pounds in 1943, 22 percent more than in 1942 and approximately equal to the normal pre-war demand of the printing trade. Consumption of newsprint in the United States, according to the Bureau of Foreign and Domestic Commerce, declined from the peak of 3,928,880 tons in 1941 to 3,661,180 in 1943 but was still above consumption in the years before 1940. Over 90 percent of the newsprint is used by newspapers.

Deliveries to paint companies in 1943 (3,945,000 pounds) were 9 percent larger than in 1942 but about 35 percent below the average of recent pre-war years. It is apparent that wartime paint requirements absorb less carbon black than those of civilians in peacetime. Conversion of the automotive industry to the production of military equipment is probably the chief factor in this change.

Sales for miscellaneous purposes in 1943 increased 51 percent over 1942 to 23,440,000 pounds, exceeding the record of 1941. The material growth in this class of demand since 1940 is probably due chiefly to expansion in the use of plastic materials containing carbon black, particularly in electrical devices.

Exports and imports.[1]—Since the peak of 1939 exports have declined almost 50 percent. The 1943 total (104,911,772 pounds) was 9 percent below 1942 and the lowest since 1932. The first major adjustment in our foreign trade in carbon black resulting from the war involved the elimination of Axis-controlled countries, which in 1939 bought approximately 39 percent (79 million pounds) of total exports. Shipments to the United Kingdom have declined consistently in the war years, doubtless reflecting the scarcity of rubber for processing there, for which finished products from the United States have been substituted when required. Declines in shipments to Argentina, Australia, New Zealand, China, and Sweden were related to transportation difficulties and scarcity of rubber. Exports to India and to several Latin American countries which were small factors in this trade before the war have risen materially.

For the first 8 months of 1943 exports averaged only about 7.5 million pounds per month. Clearances in the last 4 months, however, were at the rate of over 11,000,000 pounds per month, suggesting some improvement in the availability of ocean shipping space.

The average value of carbon black exported in 1943 rose to 4.60 cents per pound from 4.52 cents in 1942, continuing a trend which began from a low of 4.36 cents in 1939.

The Galveston customs district returned in 1943 to first importance as an export point, supplanting Michigan after a lapse of 1 year. Several districts reporting heavier traffic in carbon black for export have been added to the table, notably Georgia, which has ranked third in volume handled in 1942 and 1943.

A further sharp rise was reported in imports of "gas black and carbon black" from Canada. In 1943, 208,913 pounds valued at $20,812 were received, compared with 77,870 pounds valued at $7,307 in 1942. Acetylene black, also imported from Canada, amounted to 4,709,482 pounds (value $459,453) in 1943 and 3,840,433 pounds (value $381,204) in 1942.

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[1] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Carbon black exported from the United States, 1941–43, by countries

Country	1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value
Argentina	5, 828, 519	$287, 870	3, 215, 276	$161, 503	617, 341	$37, 656
Australia	12, 201, 171	563, 104	7, 833, 813	405, 850	3, 738, 075	172, 963
Brazil	6, 235, 139	285, 204	2, 626, 163	131, 840	6, 599, 200	321, 455
Canada	32, 760, 178	1, 118, 151	29, 650, 763	1, 070, 714	27, 667, 557	1, 044, 229
Chile	77, 166	5, 094	75, 199	5, 063	141, 425	7, 776
China	486, 667	24, 126	----	----	----	----
Colombia	13, 749	1, 003	175, 187	8, 836	736, 598	33, 939
Cuba	108, 782	9, 137	364, 475	19, 173	366, 890	21, 612
Egypt	33, 775	1, 337	186, 390	5, 331	193, 250	10, 864
Guatemala	18, 537	870	2, 493	135	35, 004	1, 728
India and Dependencies	6, 768, 852	305, 699	7, 648, 607	354, 672	9, 071, 851	427, 322
Japan	2, 274, 000	98, 447	----	----	----	----
Mexico	2, 250, 143	93, 742	4, 841, 480	133, 163	3, 251, 683	143, 162
Netherlands Indies	2, 780, 458	129, 017	756, 075	44, 458	----	----
New Zealand	662, 403	32, 571	363, 187	18, 555	227, 050	11, 293
Peru	26, 025	1, 582	900	50	320, 428	16, 081
Portugal	140, 762	8, 767	84, 997	5, 547	68, 741	4, 266
Spain	818, 500	37, 451	565, 150	28, 047	1, 373, 050	77, 414
Sweden	345, 550	17, 440	265, 275	17, 486	69, 900	5, 088
Union of South Africa	7, 668, 759	345, 536	2, 618, 460	126, 396	4, 547, 319	220, 292
United Kingdom [1]	58, 223, 076	2, 889, 741	58, 296, 513	2, 608, 449	45, 109, 474	2, 213, 845
Other countries	8, 443, 086	430, 423	1, 064, 754	83, 876	776, 938	53, 278
	148, 165, 297	6, 686, 312	115, 635, 157	5, 229, 144	104, 911, 772	4, 824, 263

[1] United Kingdom of Great Britain and Northern Ireland.

Carbon black exported from the United States, 1942–43, by months and customs districts

Month	1942		1943		Customs district	1942		1943	
	Pounds	Value	Pounds	Value		Pounds	Value	Pounds	Value
Jan	14, 843, 817	$696, 441	10, 594, 141	$469, 836	Buffalo	241, 126	$10, 872	273, 728	$17, 532
Feb	13, 440, 092	618, 850	5, 134, 731	221, 028	El Paso	1, 885, 776	79, 243	1, 665, 650	69, 171
Mar	6, 172, 113	255, 541	5, 991, 676	268, 772	Galveston	25, 776, 643	1,241,907	27, 320, 064	1,342,910
Apr	8, 179, 205	391, 223	7, 158, 444	333, 603	Georgia	15, 925, 709	770, 310	16, 451, 105	795, 373
May	4, 998, 974	224, 609	11, 184, 291	513, 556	Laredo	594, 160	29, 247	1, 586, 000	73, 975
June	15, 789, 105	767, 683	7, 498, 911	341, 777	Los Angeles	2, 725, 617	38, 798	2, 190, 403	92, 858
July	5, 144, 342	215, 649	5, 767, 363	263, 376	Michigan	29, 084, 820	1,045,644	27, 212, 702	1,016,307
Aug	11, 252, 102	537, 347	6, 587, 117	308, 136	New Orleans	14, 992, 929	799, 894	10, 645, 350	557, 055
Sept	9, 598, 078	436, 866	10, 723, 053	519, 418	New York	10, 059, 296	517, 643	8, 126, 095	400, 214
Oct	4, 919, 614	212, 930	10, 158, 283	479, 911	Philadelphia	----	----	2, 093, 116	104, 282
Nov	12, 184, 594	463, 865	12, 638, 095	585, 702	San Francisco	5, 341, 767	268, 930	2, 289, 400	106, 891
Dec	9, 113, 121	408, 140	11, 475, 667	519, 148	Other districts	9, 007, 314	426, 656	5, 058, 159	247, 695
	115,635,157	5,229,144	104,911,772	4,824,263		115,635,157	5,229,144	104,911,772	4,824,263

STOCKS

The accumulation of producers' stocks, which was large in 1942, continued through the first 5 months of 1943. In later months sales increased rapidly to levels above the rate of production and caused heavy drafts upon stocks. The producers' holdings of 242,755,000 pounds at the end of 1942 were reduced to 205,215,000 pounds on December 31, 1943, and the prospect of further growth in demand indicated a need for a higher production rate.

PRICES AND VALUES

The average value of carbon black at the plants in 1943 was reported as 3.41 cents per pound, unchanged from 1942.

Price ceilings promulgated by the Office of Price Administration have remained fixed since January 1942. For important commercial grades they range from 3.3 cents for channel black in bulk to 8.0 cents for some high-modulus furnace blacks.

Ceilings on furnace-type blacks were based upon costs, including that of gas bought under recent contracts at higher rates than formerly prevailed, particularly for supplies to channel plants. Ceilings on channel black were based primarily upon the going market price of the product at the close of 1941. Upon expiration of gas-purchase contracts it was often impracticable to renew them at the old, low rates. Therefore, with a fixed ceiling price on channel plant output, producers have faced the alternative of meeting higher costs without improvement in the sales price of their product or restricting production to that derived from gas still under their control at satisfactory prices.

To alleviate this situation and encourage expansion in channel black production, the War Production Board is requesting (May 1944) of the Office of Price Administration an increase in the ceiling price on channel black. Some downward adjustment in the price ceilings on furnace blacks may also be considered.

ASPHALT AND RELATED BITUMENS

By A. H. Redfield [1]

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SUMMARY

Refinery sales of petroleum asphalt (exclusive of road oil) to domestic consumers in the United States were less than 1 percent larger in tonnage in 1943 than in 1942, but because of higher prices they were 11 percent higher in value. As the refinery output was 7 percent larger than in 1942, inventories at the refineries increased 37 percent from December 31, 1942, to December 31, 1943. Exports of petroleum asphalt also increased, but they constituted little more than 1 percent of both domestic and foreign sales. Imports of petroleum and lake asphalt decreased 4 percent but were less than 2 percent of the total new supply in 1943.

Sales of bituminous rock were affected by the decline in road building of the more-stable types, which reduced the sales of paving asphalt from petroleum. On the other hand, sales of gilsonite were increased 26 percent in tonnage by war demands.

NATIVE ASPHALT AND BITUMENS

Bituminous rock.—Decreased road-building activity in 1943, especially by the Federal Government, resulted in a decline in sales of bituminous rock from 935,295 short tons valued at $3,367,279 in 1942 to 835,648 tons valued at $3,096,753 in 1943. Producers in Kentucky and Alabama sold only 185,723 tons valued at $1,093,981 in 1943, compared with 207,324 tons valued at $1,228,748 in 1942. Likewise, west of the Mississippi River producers in Texas and Oklahoma sold 699,572 tons valued at $2,018,822 in 1942 but only 600,545 tons valued at $1,673,689 in 1943. Sales in California also declined during the year. On the other hand, sales of bituminous rock in Missouri, a minor producing State, were larger in 1943 than in 1942. The mining of bituminous rock in Utah was resumed in 1943 after many years of inactivity.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Gilsonite and wurtzilite.—In contrast with the decline in sales of bituminous rock, increased demand in both the domestic and foreign market raised producers' sales of gilsonite in Utah from 40,041 short tons valued at $909,311 in 1942 to 50,446 tons valued at $1,188,485 in 1943. The average sales price per ton at the mine or railhead increased from $22.71 to $23.56.

Sales of wurtzilite from Utah increased from 37 short tons valued at $2,852 in 1942 to 41 tons valued at $3,250 in 1943.

Sulfonated bitumen.—Sales of natural sulfonated bitumen from Box Elder County, Utah, were less in 1943 than in 1942.

Exports.—Exports of natural unmanufactured asphalt amounted to 8,941 short tons valued at $231,772 in 1942 and to 34,796 tons valued at $819,355 in 1943. Considerably more natural asphalt was shipped to Australia and New Zealand in 1943 than in 1942, and more was exported to the United Kingdom and to the Caribbean-Gulf of Mexico region.

MANUFACTURED OR PETROLEUM ASPHALT

Production.—Production of asphalt by petroleum refineries in the United States increased 7 percent from 1942. The principal gains were in the East Coast district where completion of the Big Inch pipe line had permitted resumption of normal refining activity, the Oklahoma-Kansas-Missouri district, the Indiana-Illinois-Kentucky-etc. district, and California. In contrast with the general increase, output of asphalt declined in the Texas Gulf Coast district, Louisiana and Arkansas, and the Appalachian district.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of asphalt (exclusive of road oil) at petroleum refineries in the United States in 1943, by districts, in short tons

District	Production	Receipts from other sources	Stocks		Consumption by companies, transfers, losses, and exports	Sales to domestic consumers
			Dec. 31, 1942	Dec. 31, 1943		
East Coast	1,012,800	118,300	50,000	81,100	51,000	1,049,000
Appalachian	324,800	600	26,400	19,500	46,300	286,000
Indiana, Illinois, Kentucky, etc	1,425,000	233,900	96,700	113,800	173,100	1,468,700
Oklahoma, Kansas, and Missouri	700,100	7,000	39,600	69,300	14,700	662,700
Texas:						
Gulf Coast	435,600		23,800	29,100	68,500	361,800
Inland	410,500	2,500	20,200	32,400	21,000	379,800
Total Texas	846,100	2,500	44,000	61,500	89,500	741,600
Louisiana-Arkansas:						
Louisiana Gulf Coast	483,000	5,000	38,000	54,500	18,600	452,900
Arkansas and Louisiana Inland	356,500	9,100	22,000	28,500	11,700	347,400
Total Louisiana-Arkansas	839,500	14,100	60,000	83,000	30,300	800,300
Rocky Mountain	192,600	113,900	18,500	33,600	19,100	272,300
California	1,415,800	227,100	75,800	101,500		1,617,200
Total United States:						
1943	6,756,700	717,400	411,000	563,300	424,000	6,897,800
1942	6,296,500	1,050,900	604,000	411,000	699,600	6,840,800

Stocks.—Production of petroleum asphalt in 1943 obviously outstripped the increase in demand, as stocks held at refineries rose from 411,000 short tons on December 31, 1942, to 563,300 tons on December 31, 1943. The greatest increases in inventories were in the East Coast district, the Oklahoma-Kansas-Missouri district, California, and the Indiana-Illinois-Kentucky-etc. district. Only in the Appalachian district did a decrease in stocks run counter to the general trend.

Sales.—Sales of petroleum asphalt by refineries to domestic consumers in the United States increased less than 1 percent in quantity but 11 percent in value from 1942 to 1943. The average value at the refinery increased from $10.35 per short ton to $11.43.

Of the total sold, 4 percent was manufactured from foreign petroleum (imported chiefly from Venezuela and Mexico) in 1943 compared with 7 percent in 1942. Although runs of foreign crude oil to stills decreased only 17 percent, sales of petroleum asphalt from this source decreased 40 percent. Of the foreign crude processed, 19 percent (revised figure) was converted into asphalt in 1942 and 15 percent in 1943. East Coast refineries sold 71 percent of the total asphalt made from foreign crude in 1943 compared with 88 percent in 1942. Fully 39 percent of the sales of asphalt made from foreign crude was made by the Gulf Coast refineries of Texas and Louisiana.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries to domestic consumers in the United States in 1943, by varieties

[Value f. o. b. refinery]

Variety	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:						
Asphalt for—						
Paving	1,883,415	$21,212,772	99,042	$1,343,825	1,982,457	$22,556,597
Roofing	922,324	11,092,800	67,848	921,263	990,172	12,014,153
Waterproofing	107,857	1,551,748	1,626	24,424	109,483	1,576,172
Blending with rubber	15,420	210,217	1,090	16,731	16,510	226,948
Briquetting	117,603	1,105,994	....	....	117,603	1,105,994
Mastic and mastic cake	18,786	286,753	8,865	132,585	27,651	419,338
Pipe coatings	16,060	244,401	4	57	16,064	244,458
Molding compounds	41,467	572,865	....	....	41,467	572,865
Miscellaneous uses	219,005	2,794,403	5,917	97,415	224,922	2,891,818
	3,341,937	39,072,043	184,392	2,536,300	3,526,329	41,608,343
Semisolid and liquid products of more than 200 penetration:						
Flux for—						
Paving	297,637	2,731,597	191	2,934	297,828	2,734,531
Roofing	667,639	5,717,888	12,654	170,823	680,293	5,888,711
Waterproofing	8,513	85,833	....	....	8,513	85,833
Mastic	3	62	....	....	3	62
Cut-back asphalts:						
Rapid-curing	792,908	9,989,284	82,593	1,170,867	875,501	11,160,151
Medium-curing	1,308,002	14,980,626	20,552	294,721	1,328,554	15,275,347
Emulsified asphalts and fluxes	107,954	1,220,177	....	....	107,954	1,220,177
Paints, enamels, japans, and lacquers	36,302	538,241	....	....	36,302	538,241
Other liquid products	36,487	350,887	39	547	36,526	351,434
	3,255,445	35,614,595	116,029	1,639,892	3,371,474	37,254,487
Total:						
1943	6,597,382	74,686,638	300,421	4,176,192	6,897,803	78,862,830
1942	6,337,670	64,013,509	503,111	6,801,792	6,840,781	70,815,301

Sales of asphalt (exclusive of road oil) at petroleum refineries to domestic consumers in the United States, 1942–43, by districts

District	1942		1943	
	Short tons	Value	Short tons	Value
East Coast	982,821	$13,117,302	1,048,944	$14,675,424
Appalachian	315,883	4,243,253	286,040	3,941,154
Indiana, Illinois, Kentucky, etc	1,207,744	13,334,239	1,468,704	18,122,413
Oklahoma, Kansas, and Missouri	638,618	5,296,640	662,696	6,377,803
Texas:				
Gulf Coast	411,042	4,455,867	361,832	3,915,416
Inland	362,809	3,531,567	379,823	3,669,341
Total Texas	773,851	7,987,434	741,655	7,584,757
Louisiana-Arkansas:				
Louisiana Gulf Coast	536,107	6,109,670	452,917	5,555,905
Arkansas and Louisiana Inland	393,404	3,202,112	347,369	3,140,374
Total Louisiana-Arkansas	929,511	9,311,782	800,286	8,696,279
Rocky Mountain	364,900	3,589,734	272,323	3,196,267
California	1,627,453	13,934,917	1,617,155	16,268,733
Total United States	6,840,781	70,815,301	6,897,803	78,862,830

Highway and street construction and airport-runway surfacing used (in the form of paving asphalt, paving flux, cut-back asphalts, and asphalt emulsions) 64 percent of the total asphalt sold to domestic consumers by petroleum refineries in 1942 and 67 percent in 1943. Street and road contracts exceeding $25,000, according to the Engineering News-Record, show a decrease of 57 percent in value—from 530.5 million dollars in 1942 to 227.2 million dollars in 1943—and of 40 percent in indicated volume if the values are adjusted by the Engineering News-Record index of construction costs. The decreases were general over the country but were greatest in the 14 States lying west of the Mississippi River and east of the Rocky Mountains in the 5 States lying between the Ohio River and the Great Lakes, and in the 10 Southeastern States and Louisiana.

Nevertheless, sales of paving asphalt used for high-type surfacing decreased only 7 percent from 1942 to 1943. Government purchases, rather than private contracts, are believed to have sustained sales of paving asphalt.

In contrast with sales of paving asphalt, sales of cut-back asphalts, suitable for surfacing lighter-type highways, increased 23 percent from 1942 to 1943. Sales of rapid-curing cut-backs increased 18 percent in tonnage and of medium-curing cut-backs, 27 percent. The greatest gains were in the Indiana-Illinois-Kentucky-etc. district, the East Coast district, the Oklahoma-Kansas district, the Texas Inland district, the Louisiana Gulf Coast district, and California. On the other hand, sales of cut-back asphalts in the Appalachian, the Texas Gulf Coast, and the Rocky Mountain districts were lower in 1943 than in 1942.

Less emulsified asphalt was sold in 1943 than in 1942. Petroleum refineries sold 118,645 short tons (27,955,076 gallons) valued at $1,481,652 in 1942 and 107,954 tons (25,436,068 gallons) valued at $1,220,177 in 1943; in addition, 86,973,381 gallons valued at $8,996,057 in 1942 and 74,422,435 gallons valued at $6,973,894 in 1943 were sold by major industrial companies that purchased asphalt from petroleum refineries. Accordingly, total known sales of emulsified asphalts and fluxes decreased 13 percent in quantity—from 114,928,457 gallons in 1942 to 99,858,503 gallons in 1943—and 22 percent in value—from $10,477,709 in 1942 to $8,194,071 in 1943.

Roofing manufacture made the second-largest demand for asphalt, absorbing 27 percent of the total sales to domestic consumers in 1942 and 24 percent in 1943. Shipments of prepared roofing reported to the Bureau of the Census decreased 10 percent—from 54,106,000 squares in 1942 to 48,892,000 squares in 1943—and domestic sales of roofing asphalt and roofing flux combined decreased 11 percent—from 1,869,458 short tons in 1942 to 1,670,465 tons in 1943. Except for the Texas Gulf Coast and inland Louisiana and Arkansas, the decrease in sales of roofing asphalt and flux was general.

DISTRIBUTION BY RAIL

The tonnage of asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States decreased from 5,971,636 short tons in 1942 to 5,059,518 tons in 1943, according to freight-commodity statistics compiled by the Interstate Commerce Commission. Increased deliveries in the Middle Atlantic and in the South Atlantic States were inadequate to offset the general decline in railroad terminations. The Office of Defense Transportation, by favoring deliveries of asphalt by motor truck within a fairly wide radius of each plant, was largely responsible for the decline in railroad transport of asphalt in 1943.

Asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States, 1942–43, by States, in short tons

State and group	1942	1943
New England	156, 180	143, 799
Middle Atlantic:		
New York	164, 041	194, 426
New Jersey	101, 450	67, 523
Pennsylvania	397, 167	432, 611
Total Middle Atlantic	662, 658	694, 560
East North Central:		
Ohio	1, 105, 741	914, 857
Indiana	288, 242	219, 206
Illinois	507, 244	336, 844
Michigan	128, 353	125, 899
Wisconsin	138, 230	119, 045
Total East North Central	2, 167, 810	1, 715, 853
West North Central:		
Minnesota	86, 507	69, 791
Iowa	35, 297	29, 731
Missouri	88, 515	94, 842
North Dakota	22, 964	20, 448
South Dakota	51, 363	27, 827
Nebraska	45, 907	54, 923
Kansas	55, 652	66, 205
Total West North Central	386, 205	363, 767
South Atlantic:		
Delaware	18, 838	21, 351
Maryland	26, 347	93, 026
District of Columbia	6, 383	1, 526
Virginia	71, 888	102, 682
West Virginia	57, 050	66, 982
North Carolina	77, 187	68, 713
South Carolina	38, 059	49, 027
Georgia	84, 144	65, 959
Florida	128, 330	161, 450
Total South Atlantic	508, 226	630, 716

Asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States, 1942–43, by States, in short tons—Continued

State and group	1942	1943
East South Central:		
Kentucky	62, 520	54, 521
Tennessee	85, 578	61, 599
Alabama	80, 326	51, 633
Mississippi	68, 424	45, 527
Total East South Central	296, 848	213, 280
West South Central:		
Arkansas	52, 209	50, 924
Louisiana	121, 935	99, 070
Oklahoma	20, 146	39, 967
Texas	245, 563	182, 347
Total West South Central	439, 853	372, 308
Mountain:		
Montana	71, 592	7, 592
Idaho	37, 459	35, 627
Wyoming	23, 949	3, 817
Colorado	99, 362	62, 928
New Mexico	61, 557	60, 560
Arizona	162, 675	96, 870
Utah	39, 887	47, 191
Nevada	58, 709	49, 431
Total Mountain	555, 190	364, 016
Pacific:		
Washington	122, 788	134, 945
Oregon	132, 220	82, 230
California	543, 658	344, 044
Total Pacific	798, 666	561, 219
Total United States	5, 971, 636	5, 059, 518
Canada	1, 300	7, 440
Total terminated	5, 972, 936	5, 066, 958

Source: Interstate Commerce Commission, Freight Commodity Statistics.

FOREIGN TRADE

Imports.—Imports of natural asphalt and bitumen into the United States in 1943 totaled 8,142 short tons valued at $221,503 compared with 7,961 tons valued at $136,054 in 1942. Imports of lake asphalt from Trinidad increased from 6,122 tons valued at $79,817 in 1942 to 6,966 tons valued at $202,082 in 1943, but imports of grahamite from Cuba decreased from 1,351 tons valued at $24,741 to 999 tons valued at $17,900.

Imports of solid asphalt increased from 68,638 short tons valued at $309,140 in 1942 to 101,089 tons valued at $567,832 in 1943. Of the 1943 imports, virtually all came from the Netherlands West Indies.

In addition, 255,934 barrels (46,533 tons) valued at $370,606 of liquid petroleum asphalt, including cutbacks and road oil, were imported in 1942 and 51,409 barrels (9,347 tons) valued at $91,001 in 1943. Mexico supplied all the liquid petroleum asphalt imported in 1943.

Exports.—Exports of petroleum asphalt increased 7 percent from 1942 to 1943 but still remained nearly 60 percent below the 1941 level. The principal gains in 1943 were in shipments to Australia and New Zealand, Nigeria and other African war bases, and British India. Exports to North American countries declined, as did shipments to South America, except to Chile and Uruguay. Asphalt exports to Europe, negligible in 1942, virtually reached the vanishing point in 1943.

Petroleum asphalt exported from the United States, 1941–43, by countries

Country	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Canada	23,063	$377,710	9,918	$246,346	3,607	$196,573
Cuba	6,150	111,196	138	4,659	80	1,832
Guatemala	3,919	52,554	1,462	73,446	728	17,204
Mexico	5,988	61,051	2,803	49,477	3,891	74,698
Newfoundland and Labrador	7,395	147,853	5,564	108,314	4,109	86,070
Nicaragua	4,115	62,602	1,186	20,792	1,158	23,258
Panama:						
Canal Zone	3,342	58,610	24,166	384,192	8,956	201,406
Republic of	469	7,942	2,657	54,091	51	1,626
Other North America	6,436	114,373	4,981	71,462	5,283	107,772
	60,877	993,891	52,875	1,012,779	27,863	710,439
South America:						
Argentina	252	8,682	6	341	3	120
Brazil	10,797	160,315	3,455	64,588	1,116	33,965
Chile	6,448	111,870	2,362	43,908	3,577	69,831
Uruguay	3,997	61,830	279	5,117	762	14,023
Venezuela	1,453	28,472	477	9,900	133	5,786
Other South America	2,886	39,139	2,334	31,596	434	8,978
	25,833	410,308	8,913	155,450	6,025	132,703
Europe:						
Spain	11,187	198,826	----------	----------	8	326
Sweden	718	37,665	10	598	----------	----------
United Kingdom [1]	833	38,335	442	20,559	----------	----------
Other Europe	570	10,022	26	1,573	----------	----------
	13,308	284,848	478	22,730	8	326
Asia:						
India and Dependencies	20,571	339,972	4,111	99,429	5,120	121,920
Other Asia	51,921	822,674	5	205	68	3,284
	72,492	1,162,646	4,116	99,634	5,188	125,204
Africa:						
Belgian Congo	107	2,157	53	2,212	74	1,980
British East Africa	1,691	31,566	33	1,037	59	4,092
Mozambique	3,820	58,454	46	4,040	----------	----------
Nigeria	22	435	547	18,011	2,741	91,165
Union of South Africa	6,814	158,154	517	9,756	683	29,056
Other Africa	520	10,291	482	16,378	1,605	53,208
	12,974	261,057	1,678	51,434	5,162	179,501
Oceania:						
Australia	32,086	473,982	12,528	171,526	34,582	850,118
New Zealand	7,367	102,640	4,048	68,530	12,311	282,329
Other Oceania	11	130	168	3,410	----------	----------
	39,464	576,752	16,744	243,466	46,893	1,132,447
	224,948	3,689,502	84,804	1,585,493	91,139	2,280,620

[1] United Kingdom of Great Britain and Northern Ireland.

ROAD OIL

The manufacture and sale of road oil were reported in 1943 chiefly by the Rocky Mountain district and California. What was sold in 1943 as road oil might better have been described as liquid asphalt, as the use of road oil for paving purposes had been officially prohibited. Recommendation No. 45 of the Petroleum Coordinator for War, dated April 24, 1942, which placed asphalt surfacing in the Eastern Seaboard States under control of the Public Roads Administration, did not permit the use of road oil during the emergency; by October 5, 1942, this control and this prohibition were valid over the entire continental United States. Petroleum Directive No. 66, of the Petroleum Administration for War, dated May 22, 1943, defined the types of asphalt permitted to be used for paving purposes or laying dust, and limited these to asphalt cements, cutbacks, and emulsions. After the revocation of Recommendation No. 45, Petroleum Directive No. 72 of the Petroleum Administration for War dated September 9, 1943, continued the restrictions on the delivery or acceptance of road oil for use as a paving material or as a dust palliative. Accordingly, the statistics of road oil for 1943 refer to liquid asphalts having a penetration less than 350 after distillation to 680° F.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of road oil in the United States in 1943, by districts, in thousands of barrels

District	Production	Receipts from other sources	Stocks		Consumption by companies, transfers, losses, and exports	Sales to domestic consumers
			Dec. 31, 1942	Dec. 31, 1943		
East Coast	12	1	1	10	3	1
Appalachian						
Indiana, Illinois, Kentucky, etc	41		13		19	35
Oklahoma, Kansas, and Missouri	51	1	34	5	29	52
Texas	−44		51	5		2
Louisiana-Arkansas	22		15	3	34	
Rocky Mountain	807	185	117	79	344	686
California	1,406		117	91	154	1,278
Total: 1943	2,295	187	348	193	583	2,054
1942	8,039	643	793	348	2,000	7,127

Road oil sold by petroleum refineries to domestic consumers in the United States, 1942–43, by districts

District	1942		1943	
	Thousands of barrels	Thousands of dollars	Thousands of barrels	Thousands of dollars
East Coast	106	192	1	2
Appalachian	31	71		
Indiana, Illinois, Kentucky, etc	1,278	1,968	35	53
Oklahoma, Kansas, and Missouri	360	529	52	89
Texas	80	127	2	7
Louisiana-Arkansas	17	56		
Rocky Mountain	1,197	1,729	686	1,137
California	4,058	4,931	1,278	2,558
Total United States	7,127	9,603	2,054	3,846

POST-WAR PROSPECTS

The prospects of the asphalt industry immediately after the end of the present war seem quite favorable. The cessation of hostilities will find the highways of the United States in comparatively poor condition. Although the highways have been subjected to additional wear through troop movements and freight shipments, little new construction was undertaken during 1942 and 1943 except in the vicinity of camps and cantonments, and maintenance was generally skimped. Undoubtedly a demand will arise at the end of the war to restore the highways to their previous condition; in fact, post-war highway projects to a total value of 1.3 billion dollars have been reported to the Engineering News-Record. These projects in turn should create a demand for paving asphalt, paving flux, cut-back asphalts, and asphalt emulsions.

Moreover, building construction for residential and business purposes, especially that financed by private funds, has lagged during the war. At the end of the war the pent-up demand for small residences and apartments and small business structures should revive building construction. Estimates of the total value of this anticipated construction by the Engineering News-Record range between 2 and 3 billion dollars. Roofing asphalt and flux, waterproofing asphalt and flux, mastic, pipe coatings, and paints and enamels should benefit by any revival of building construction.

CEMENT

By Forrest T. Moyer and E. V. Balser

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SUMMARY

The demand for hydraulic cements declined sharply in 1943 as the construction phase of the war program neared completion and structural activity fell rapidly. Total production of 135,254,054 barrels of hydraulic cements was 27 percent below the record set in 1942, a reduction that resulted from respective decreases of 27 and 29 percent in output of portland cement and of a grouping of all other hydraulic cements (natural, masonry, puzzolan, and hydraulic lime). The portland-cement industry operated at 55 percent, and the "All other" group at 44 percent of productive capacity in 1943. Mill shipments fell 31 percent below the high annual volume of 1942 and totaled 129,478,662 barrels. Demand for portland cement, as gaged by shipments, declined nearly one-third, and for the group of all other hydraulic cements decreased about one-fourth from 1942. As production exceeded shipments by nearly 6 million barrels, stocks of all hydraulic cements at mills on December 31, 1943, advanced to 23,408,972 barrels or 33 percent above the quantity on hand at the close of 1942. During 1943 no adjustments were made in the permitted maximum prices for cement which had been frozen at the levels of March 1 to 15, 1942. The average net mill realization per barrel of portland cement increased 4 cents over 1942 to $1.57 in 1943, whereas that for the "All other hydraulic cements" group dropped 18 cents to $1.28 in 1943.

Although the peak activity of the war construction program reportedly was reached during the July-September quarter of 1942, the long-term trend in production of cement continued upward until February 1943. This extension past the turning point in structural activity resulted from the necessity to rebuild the depleted stocks of cement to the customary operating level as well as to meet the strong demand. In February the steady rise that had started in the middle of 1940 was reversed sharply, and the long-term trend declined at an accelerating rate each month through November. In December the rate of decline lessened slightly, but a sizable proportion of the month's production entered stocks.

Through 1943, monthly output of cement bore little resemblance to the usual seasonal pattern. Peak monthly volume was attained in January, and after a sharp decline in February output was built up at a much less than seasonal rate through May. During June–October production fell in each successive month, whereas customarily there is a slightly rising trend through this period. The rate of decline in November was greater and in December was less than the common seasonal decreases for these months. December output was lower than in any other month of 1943.

Salient statistics of the cement industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Production of finished cement:					
Portland..........barrels..	122, 259, 154	130, 216, 511	164, 030, 559	182, 781, 184	133, 423, 788
Masonry, natural, and puzzolan (slag-lime)..........barrels..	2, 439, 110	2, 534, 566	2, 875, 962	2, 560, 425	1, 830, 266
Total production..........do....	124, 698, 264	132, 751, 077	166, 906, 521	185, 341, 609	135, 254, 054
Capacity used at portland-cement mills..........percent..	47. 7	51. 2	66. 3	73. 5	55. 0
Production of portland-cement clinker [1] barrels..	121, 620, 018	130, 140, 932	163, 628, 857	181, 267, 461	135, 692, 400
Active plants:					
Portland..........	150	152	155	156	153
Masonry, natural, and puzzolan (slag-lime)..........	12	12	12	11	10
Shipments from mills:					
Portland..........barrels..	122, 651, 459	130, 349, 786	167, 439, 237	185, 300, 884	127, 631, 859
Value [2]..........	$180, 893, 208	$190, 078, 068	$246, 621, 914	$283, 237, 028	$200, 103, 216
Per barrel..........	$1. 47	$1. 46	$1. 47	$1. 53	$1. 57
Masonry, natural, and puzzolan (slag-lime)..........barrels..	2, 405, 135	2, 514, 597	2, 926, 203	2, 508, 324	1, 846, 803
Value [2]..........	$3, 361, 724	$3, 386, 801	$3, 967, 567	$3, 668, 169	$2, 357, 112
Per barrel..........	$1. 40	$1. 35	$1. 36	$1. 46	$1. 28
Total shipments..........barrels..	125, 056, 594	132, 864, 383	170, 365, 440	187, 809, 208	129, 478, 662
Value..........	$184, 254, 932	$193, 464, 869	$250, 589, 481	$286, 905, 197	$202, 460, 328
Stocks at mills, Dec. 31:					
Portland:					
Finished cement..........barrels..	23, 645, 583	23, 364, 657	19, 964, 918	[3] 17, 380, 273	23, 172, 202
Clinker..........do....	5, 165, 066	4, 885, 941	4, 574, 528	3, 509, 336	5, 959, 170
Masonry, natural, and puzzolan (slag-lime)..........barrels..	239, 938	259, 868	199, 365	[3] 253, 307	236, 770
Imports..........do....	1, 913, 853	538, 060	43, 466	644	(4)
Exports..........do....	1, 146, 339	1, 667, 595	2, 556, 234	1, 100, 826	(4)
Apparent consumption..........do....	125, 824, 108	131, 734, 848	167, 852, 672	186, 709, 026	(4)

[1] Compiled from monthly reports by producers.
[2] Value received f. o. b. mill, excluding cost of containers.
[3] Revised figures.
[4] Figures not available for publication.

Demand for cement, as measured by mill shipments, had shown a long-term uptrend through 1941–42 nearly similar to that of production. This uptrend in demand continued beyond the record high structural activity of the third quarter of 1942 and was not interrupted until December 1942. It turned definitely downward in March 1943 at a rate of decline that, although somewhat variable, accelerated rapidly through October. The rate of decrease was eased slightly during November and December. Monthly shipments in 1943 advanced from a January-February level to the peak monthly volume of the year in April. Contrary to the usual seasonal pattern, the monthly movement during April–September fluctuated in a relatively narrow range. The volume fell rapidly through October–December and in December reached the lowest monthly quantity of the year.

The second year of war effected further changes in the location of consumption of cement, and the Southern States became the leading consuming region of continental United States (see fig. 1). Consumption in 1943, as indicated by destinations of shipments of portland cement, slumped from 1942 in each of the socioeconomic regions [1] of the country at varying rates of decline that ranged from 23 percent in the Pacific States to 38 percent in the Northeastern States.

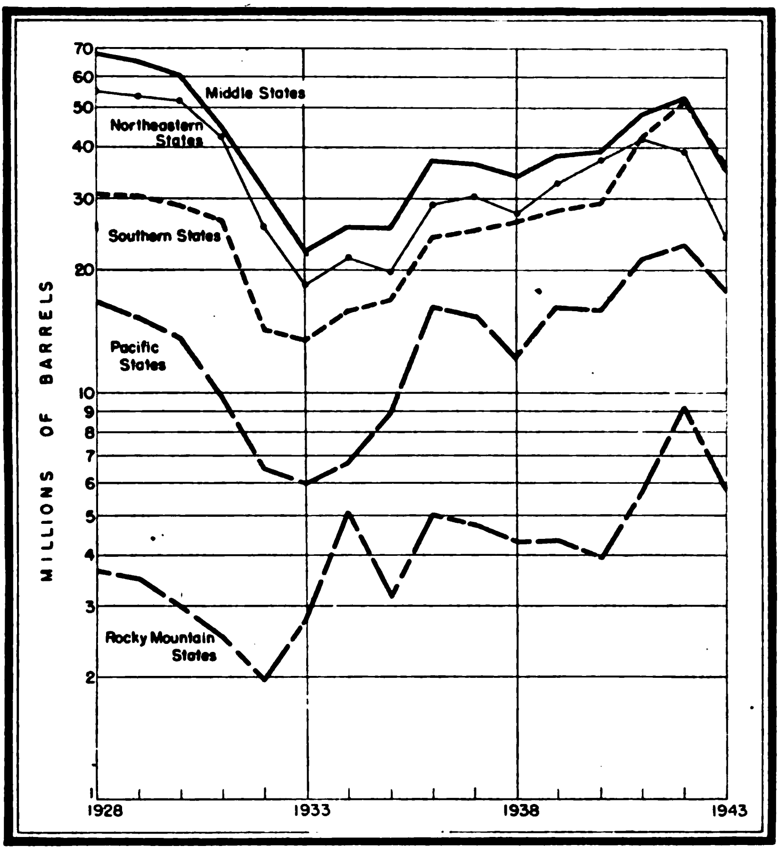

Figure 1.—Trends of indicated consumption of portland cement in continental United States, 1928–43, by regions.

The declines in output and mill shipments of cement in 1943 were less severe than the slump in construction activity, owing to continuation of the uptrend in demand for cement into the beginning of 1943 while structural activity was declining. Total new construction activity in 1943, as estimated upon a value basis by the United States Department of Commerce, was off 42 percent from 1942. Residential building contracts awarded, according to Dodge Corporation data for 37 Eastern States, declined 52 percent, and contracts for all other construction were 63 percent below the corresponding awards in 1942. Contracts for engineering construction, as reported by the Engineering News-Record, fell two-thirds below the 1942 value. The volume of construction that was contracted in 1942 but did not consume cement until in 1943 was indicated by the Portland Cement Association's data on concrete paving contracted and completed. In 1943 contracts were awarded for 71,089,671 square yards, whereas 93,650,221 square yards were completed. Concrete paving completed at airports in 1943 represented slightly more than two-thirds of the total and was only 20 percent below the record area of 1942. Road, street, and alley paving declined 35 percent from the yardage completed in 1942.

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[1] Bureau of Mines Minerals Yearbook, 1942, p. 1204.

War controls on the cement industries were increased during 1943 and were directed primarily toward conservation of manpower, equipment, fuel, power, and transportation facilities. The general order limiting construction, Conservation Order L-41 of the War Production Board, was amended several times, and major revisions of November 1, 1943, and April 19, 1944, were more restrictive in total effect on new construction than the preceding ones. Regulation of highway construction was removed from the general order on April 19, 1944, and the restrictions were eased slightly under the new control, Conservation Order L-41-e, which permitted the construction of four classes of road or street work without prior authorization. The War Production Board, through its Facilities Committee composed of representatives of several Federal agencies, continued to restrict construction through 1943 to the minimum necessary for essential military and civilian needs. General Limitation Order L-179 [2] on the portland-cement industry was amended on February 16 and March 23, 1943, by removing the ban on assignment of bin space to customers and the restrictions on testing. This order permits, with several exceptions, production only of the general-use, moderate-heat, and high-early-strength types of portland cement. Emergency alternate specifications of the American Society for Testing Materials covering the three permitted types of portland cement were continued throughout 1943. The limitations of the Federal emergency alternate specifications of June 5, 1942, covering the three types of portland cement were incorporated in the regular specifications (SS-C-158a, 191b, 201a, and 201b) by Amendment 1 of August 13, 1943. Preference Rating Order P-56, under which cement producers get priority ratings from the War Production Board to obtain maintenance, repair, operating supplies, and new capital equipment, was amended several times during 1943. Reportedly, it was difficult to obtain items of major plant and quarry equipment.

Car-loading requirements on cement were not changed in the revised regulation, General Order ODT 18A of the Office of Defense Transportation. However, loading requirements on shipments of cement in containers for dealers' warehouse stocks were relaxed on November 1, by Amendment 1 to General Permit ODT 18A-1. As a means of conserving transportation facilities and reducing excessive haulage, all "interzone" rail and truck deliveries greater than 20,000 pounds (about 50 barrels) of bulk or packed general use and moderate-heat (types I and II) portland cements were placed under control September 25 by the War Production Board in Schedule 1 of General

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[2] Bureau of Mines Minerals Yearbook 1942, p. 1195.

Haulage Conservation Order T-1. The 93 zones set forth in the schedule were consolidated to 73 in the amended forms effective February 1, 1944. Under these regulations, authorization of the War Production Board was required only to make shipments by truck or rail from a point of origin in one zone into another zone; and shipments within a zone, or made entirely by water, or for a distance of 50 miles or less or of other types of portland cement were not subject to the controls. The haulage restrictions on cement were suspended March 10, 1944, because the controls were believed to be discriminatory, inasmuch as portland cement was the only solid commodity so regulated.. During the period that "interzone" shipments were controlled, a number of cement companies used Certificate 93 of July 10, 1943, to Haulage Request TR-2 as a means of accommodating established customers in other zones. Under this provision, the producers were permitted to exchange materials and facilities and the participants in such arrangements were protected from antitrust action. This request (TR-2) continued in effect after Schedule 1 of General Haulage Conservation Order T-1 was suspended and provided a voluntary means of conserving transportation facilities.

The cement-pricing methods[3] of Maximum Price Regulation 224 were continued through 1943. Supplemental Order 53 of the Office of Price Administration, effective September 8, provided a flexible pricing provision. An amendment (No. 4), effective January 11, 1944, clarified methods of pricing sales to exporters and brought the cement regulation (No. 224) in line with the Second Revised Maximum Export Price Regulation on direct export sales. Amendment 5 of January 18, 1944, to the cement order (No. 224) removed the requirement of reporting all sales of cement outside the producer's normal market area to the Office of Price Administration. A maximum increase of 20 cents per barrel in producers' and dealers' prices of general-use, high-early-strength, and other types of portland cement for sales in the northeastern section of the country was allowed in Amendment 6, effective April 20, 1944, to Maximum Price Regulation 224. This price adjustment did not apply to sales of white portland, natural, masonry, or other modified types of cement. Ceiling prices on hydraulic lime in 1943 were unchanged from the March 1942 maximums established by Maximum Price Regulation 188 of August 1, 1942.

Culminating a long period of investigation the Federal Trade Commission, on July 17, 1943, issued an order[4] directing the Cement Institute and 75 member corporations to stop engaging in or continuing any combination to sell cement at prices set by use of the multiple basing-point, delivered-price system or by use of any other plan that results in identical price quotations or prices. The order claimed that the respondents' practices violated the Federal Trade Commission Act and resulted in price discrimination among customers in violation of the Robinson-Patman Act. Some claimed effects of the practices were restraint of competition in the sale and distribution of cement between States, depriving purchasers of the benefits of price competition, maintenance of artificial and monopolistic prices, preventing purchasers from selecting their own means of transporting cement (especially by truck and boat), maintenance of a classification of customers, maintenance of uniform conditions and terms of sale, and hindering the sale of imported cement. The order listed 17 specific practices that are termed unfair and prohibits use of these or any similar means that would accomplish the same ends.

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[3] Bureau of Mines Minerals Yearbook 1942, p. 1195.

[4] Federal Trade Commission, In the Matter of Cement Institute, et al., Order to Cease and Desist: Docket 3167, July 17, 1943, 134 pp. and Order.

The respondents filed petitions [5] of appeal on July 28, and the case was certified to the Seventh Circuit Court of Appeals in Chicago. The court granted the producers until March 20, 1944, to file their statement of points and evidence, and after that granted the Federal Trade Commission until June 10, 1944, to submit its review.

Cement producers in all sections of the country reported labor shortages, high rates of labor turn-over, and sharply increased costs of production. Wage-earner employment, according to the Bureau of Labor Statistics, in January 1943 was 115.0 percent of the 1939 monthly average and declined steadily in each month to 87.7 percent in December. As a measure of the increased labor costs resulting from wage increases and overtime rates of pay, the index of wage-earner pay rolls in 1943 was 141.2 compared with 100 in 1939. The monthly indexes (1939 monthly average=100) ranged between 149.9 in January and 127.4 in December. Increases in basic wage rates were reported by some producers in Pennsylvania, West Virginia, Ohio, Illinois, Tennessee, Missouri, and California; the reported increases ranged from 2 to 5½ cents per hour. Labor costs were raised considerably by the overtime rates of pay at the many plants that operated on a 48-hour workweek in place of the former 40-hour week as a means of solving the labor shortage or of holding current labor forces. Fixed production costs per barrel of output, such as capital investment and plant depreciation, mounted rapidly in 1943 as the volume of production fell with the declining demand for cement. Other factors that increased production costs were the rising costs of fuel, supplies, and repair parts.

POST-WAR OUTLOOK

Although the outlook for the cement industry is dismal for the duration of the European War and possibly the Far Eastern War, the post-war prospects are excellent. War restrictions on construction, effective since April 1942, have resulted in a large backlog of deferred civilian and public construction, of which the largest volumes probably are for highways and buildings. By the end of the war, highways will have deteriorated badly and will need extensive repairs and modernization, the extent of which may be gaged by the American Association of State Highway Officials' estimate that, as of July 1943, approximately 7 billion dollars would be required to repair and modernize existing highways in the State systems. The scope of new highway construction is exemplified by the proposed construction, over a period of years, of a system of interregional highways totaling 34,000 miles. All planners agree on the need for new highways and disagree only on the proportional participations of the State and Federal Governments, on the mileage allocations, and on the rates of construction. Forecasts of residential building have unanimity in predicting large annual volumes for a period of years beginning immediately after war restrictions are removed. Farm building also is expected to rise to high levels. Surprisingly, airport paving probably will bulk large in post-war construction because of the greater load requirements necessitated by the increasing size of planes and of other factors that kept airport design in a constant state of flux and have resulted in early obsolescence of airfields. Also, airplane flight strips flanking major highways in all parts of the country are planned. In addition to highways, some other public-works programs under consideration include rural-road improvement, bridge construction, slum clearance, river and harbor improvement, and large dams for flood control and irrigation. The Dodge Corporation estimates that the total physical volume of construction in the 10 years following the present war will be double the relatively low average annual volume of the 1930–39 period and about 5 percent above the relatively high activity in the 1920–29 decade.

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[5] Petition to Review and Set Aside Order of the Federal Trade Commission, Cement Institute Against Federal Trade Commission in the United States Circuit Court of Appeals for the Seventh Circuit: Donovan, Leisure, Newton & Lombard (legal firm), 1943, New York, 18 pp.

Petition to Review and Set Aside Order of the Federal Trade Commission, Aetna Portland Cement Co. et al. Against Federal Trade Commission in the United States Circuit Court of Appeals for the Seventh Circuit: Donovan, Leisure, Newton & Lombard (legal firm), 1943, New York, 250 pp.

The eminently favorable prospects for construction activity foretell widespread and large markets for cement in the post-war period. In addition, soil-cement construction is being accepted rapidly and opens extensive new fields for the use of cement.

PORTLAND CEMENT

PRODUCTION, SHIPMENTS, AND STOCKS

As annual production of portland cement represents 99 percent of the total output of all hydraulic cements, the general conditions affecting and the activity of the portland-cement industry during 1943 were the same as those given in the preceding summary.

The 1943 output of portland cement was obtained from 153 active plants in 34 States and Puerto Rico. The leading States, in order of production, were Pennsylvania, California, Texas, Michigan, and Ohio. Production was sharply lower than in 1942 in all Bureau of Mines districts in continental United States; the rates of decline ranged from 11 percent in Colorado-Montana-Utah-Wyoming-Idaho to 44 percent in New York-Maine. In Puerto Rico, however, output in 1943 nearly doubled that in 1942.

Shipments from mills during 1943 were below production in all districts except Michigan, Oregon-Washington, and Puerto Rico, and these excepted districts were the only ones to show lower stocks on December 31, 1943, than on the same date of 1942.

Finished portland cement produced, shipped, and in stock in the United States, 1942–43, by States and districts

State and district	Active plants		Production			Shipments from mills								Stocks at mills (Dec. 31)		
	1942	1943	Barrels		Percent of change from 1942	1942			1943					Barrels		Percent of change from 1942
			1942	1943		Barrels	Value		Barrels	Value		Percent of change from 1942 in—		1942 [1]	1943	
							Total	Average		Total	Average	Barrels	Average value			
STATE																
Alabama	6	6	8, 534, 324	7, 560, 462	−11. 4	8, 598, 332	$12, 874, 701	$1. 50	7, 368, 567	$10, 943, 926	$1. 49	−14. 3	−0. 7	281, 209	473, 104	+68. 2
California	12	12	23, 350, 674	18, 468, 169	−20. 9	23, 787, 808	36, 895, 916	1. 55	17, 806, 731	27, 517, 926	1. 55	−25. 1	------	891, 877	1, 553, 315	+74. 2
Illinois	4	4	7, 049, 636	4, 682, 139	−33. 6	7, 102, 393	10, 284, 111	1. 45	4, 307, 278	6, 657, 889	1. 55	−39. 4	+6. 9	538, 088	912, 949	+60. 7
Iowa	5	5	5, 062, 230	4, 569, 899	−9. 7	5, 662, 733	9, 151, 499	1. 62	3, 912, 307	6, 335, 173	1. 62	−30. 9	------	669, 226	1, 326, 818	+98. 3
Kansas	6	6	7, 254, 906	5, 958, 999	−17. 9	7, 726, 291	11, 415, 377	1. 48	5, 305, 798	8, 035, 559	1. 51	−31. 3	+2. 0	543, 221	1, 196, 422	+120. 2
Michigan	11	10	10, 615, 927	6, 246, 291	−41. 2	10, 349, 104	14, 683, 683	1. 42	6, 430, 404	9, 285, 815	1. 44	−37. 9	+1. 4	1, 976, 619	1, 792, 506	− 9. 3
Missouri	5	5	6, 971, 938	4, 781, 744	−31. 4	7, 397, 960	11, 515, 907	1. 56	4, 464, 943	7, 024, 285	1. 57	−39. 6	+. 6	561, 567	878, 368	+56. 4
New York	11	11	11, 067, 269	6, 162, 085	−44. 3	11, 027, 118	16, 030, 995	1. 45	5, 914, 660	8, 765, 665	1. 48	−46. 4	+2. 1	1, 818, 847	2, 066, 272	+13. 6
Ohio	9	9	8, 181, 615	6, 412, 566	−21. 6	8, 652, 196	11, 897, 607	1. 38	6. 096, 187	8, 798, 964	1. 44	−29. 5	+4. 3	798, 020	1, 114, 399	+39. 6
Pennsylvania	24	25	34, 114, 074	19, 793, 533	−42. 0	33, 639, 025	46, 377. 469	1. 38	19, 551, 388	27, 907, 236	1. 43	−41. 9	+3. 6	4, 794, 977	5, 037, 122	+5. 0
Puerto Rico	2	2	666, 698	977, 950	+46. 7	629, 358	1, 516, 075	2. 41	982, 087	2, 290, 957	2. 33	+56. 0	−3. 3	37, 643	33, 506	−11. 0
Tennessee	6	6	6, 402, 291	4, 774, 089	−25. 4	6, 407, 196	9, 927, 895	1. 55	4, 579, 526	7, 342, 894	1. 60	−28. 5	+3. 2	395, 690	590, 253	+49. 2
Texas	10	10	12, 132, 707	9, 580, 199	−21. 0	12, 139, 800	20, 942, 867	1. 73	9, 177, 392	15, 635, 708	1. 70	−24. 4	−1. 7	732, 288	1, 135, 095	+55. 0
Other States [3] [4]	44	42	41, 376, 895	33, 455, 663	−19. 1	42, 181, 570	69, 722, 926	1. 65	31, 734, 591	53, 561, 219	1. 69	−24. 8	+2. 4	3, 341, 001	5, 062, 073	+51. 5
	155	153	182, 781, 184	133, 423, 788	−27. 0	185, 300, 884	283, 237, 028	1. 53	127, 631, 859	200, 103, 216	1. 57	−31. 1	+2. 6	17, 380, 273	23, 172, 202	+33. 3
DISTRICT																
Eastern Pennsylvania, New Jersey, and Maryland [4]	22	22	31, 520, 249	18, 318, 790	−41. 9	31, 069, 918	42, 770, 279	1. 38	18, 314, 984	26, 014, 958	1. 42	−41. 1	+2. 9	4, 137, 559	4, 141, 365	+0. 1
New York and Maine	12	12	11, 707, 273	6, 595, 271	−43. 7	11, 644, 827	17, 054, 936	1. 46	6, 340, 734	9, 481, 973	1. 50	−45. 5	+2. 7	1, 919, 145	2, 173, 682	+13. 3
Ohio, western Pennsylvania, and West Virginia	17	17	15, 573, 618	11, 425, 914	−26. 6	16, 043, 856	22, 165, 074	1. 38	10, 834, 115	15, 530, 931	1. 43	−32. 5	+3. 6	1, 984, 905	2, 576, 704	+29. 8
Michigan	11	10	10, 615, 927	6, 246, 291	−41. 2	10, 349, 104	14, 683, 683	1. 42	6, 430, 404	9, 285, 815	1. 44	−37. 9	+1. 4	1, 976, 619	1, 792, 506	−9. 3
Wisconsin, Illinois, Indiana, and Kentucky	11	10	18, 618, 434	12, 307, 938	−33. 9	18, 658, 231	27, 941, 361	1. 50	11, 138, 338	17, 147, 425	1. 54	−40. 3	+2. 7	1, 534, 833	2, 704, 433	+76. 2
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	18	18	21, 808, 052	18, 860, 723	−13. 5	21, 864, 073	34, 063, 252	1. 56	18, 323, 150	28, 759, 863	1. 57	−16. 2	+. 6	1, 052, 224	1, 589, 797	+51. 1

Eastern Missouri, Iowa, Minnesota, and South Dakota	11	11	12,833,837	9,832,083	−23.4	13,896,927	22,058,737	1.59	8,718,046	13,997,346	1.61	−37.3	+1.3	1,370,623	2,484,660	+81.3
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	12	12	13,718,391	11,846,847	−13.6	14,687,616	22,375,075	1.52	10,586,137	16,505,743	1.56	−27.9	+2.6	867,528	2,128,238	+145.3
Texas	10	10	12,132,707	9,580,199	−21.0	12,139,800	20,942,867	1.73	9,177,392	15,635,708	1.70	−24.4	−1.7	732,288	1,135,095	+55.0
Colorado, Montana, Utah, Wyoming, and Idaho	8	8	4,371,442	3,876,825	−11.3	4,588,428	8,766,019	1.91	3,788,859	7,227,380	1.91	−17.4	------	319,146	407,112	+27.6
California	12	12	23,350,674	18,468,169	−20.9	23,787,808	36,895,916	1.55	17,806,731	27,517,926	1.55	−25.1	------	891,877	1,553,315	+74.2
Oregon and Washington	9	9	5,863,882	5,086,788	−13.3	5,940,938	12,003,754	2.02	5,190,882	10,707,191	2.06	−12.6	+2.0	555,883	451,789	−18.7
Puerto Rico	2	2	666,698	977,950	+46.7	629,358	1,516,075	2.41	982,087	2,290,957	2.33	+56.0	−3.3	37,643	33,506	−11.0
	155	153[4]	182,781,184	133,423,788	−27.0	185,300,884	283,237,028	1.53	127,631,859	200,103,216	1.57	−31.1	+2.6	17,380,273	23,172,202	+33.3

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[1] Revised figures.

[2] Subject to revision.

[3] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

[4] Does not include New Jersey for 1943; production and shipments were discontinued July 1942.

Production, shipments from mills, and stocks at mills of finished portland cement in the United States in 1943, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania and Maryland	1, 882	1, 643	1, 775	1, 618	1, 555	1, 431	1, 557	1, 574	1, 499	1, 562	1, 104	1, 124
New York and Maine	601	355	192	498	653	617	667	663	651	594	597	496
Ohio, western Pennsylvania, and West Virginia	997	780	1, 019	951	1, 059	1, 089	1, 067	995	1, 057	1, 064	753	610
Michigan	571	367	385	213	802	739	613	627	559	532	513	342
Wisconsin, Illinois, Indiana, and Kentucky	1, 387	1, 188	1, 108	940	851	1, 007	1, 084	1, 077	1, 148	860	835	823
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	1, 690	1, 553	1, 680	1, 624	1, 609	1, 643	1, 730	1, 714	1, 522	1, 515	1, 345	1, 237
Eastern Missouri, Iowa, Minnesota, and South Dakota	972	680	637	791	1, 014	925	927	815	853	844	781	596
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1, 076	871	1, 113	1, 200	1, 206	1, 050	967	976	927	907	790	811
Texas	809	687	996	862	925	866	832	821	730	788	730	534
Colorado, Montana, Utah, Wyoming, and Idaho	278	239	220	358	449	390	410	358	382	368	263	165
California	1, 884	1, 561	1, 740	1, 680	1, 701	1, 597	1, 482	1, 489	1, 469	1, 603	1, 160	1, 095
Oregon and Washington	335	307	446	417	501	474	461	471	502	479	330	352
Puerto Rico	78	62	81	87	59	67	83	93	81	73	79	133
United States: 1943	12, 560	10, 293	11, 392	11, 239	12, 384	11, 895	11, 880	11, 673	11, 380	11, 189	9, 280	8, 318
1942 [1]	12, 360	10, 797	12, 733	14, 067	16, 119	16, 022	16, 833	17, 605	17, 541	18, 293	16, 273	14, 116
SHIPMENTS												
Eastern Pennsylvania and Maryland	1, 378	1, 063	1, 478	1, 825	1, 886	1, 972	1, 853	1, 816	1, 630	1, 399	1, 275	738
New York and Maine	285	249	377	512	611	764	785	760	771	618	380	220
Ohio, western Pennsylvania, and West Virginia	576	549	715	921	991	1, 153	1, 224	1, 295	1, 181	1, 036	785	419
Michigan	207	212	274	489	574	717	720	848	846	811	491	241
Wisconsin, Illinois, Indiana, and Kentucky	715	580	742	1, 058	924	1, 195	1, 218	1, 304	1, 257	1, 090	642	413
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	1, 549	1, 498	1, 475	1, 746	1, 749	1, 756	1, 601	1, 617	1, 528	1, 615	1, 304	882
Eastern Missouri, Iowa, Minnesota, and South Dakota	285	402	527	919	865	936	909	926	1, 218	986	425	320
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	915	1, 027	1, 114	1, 403	887	835	874	950	934	749	598	303
Texas	668	929	897	970	841	865	778	811	683	723	603	409
Colorado, Montana, Utah, Wyoming, and Idaho	158	225	294	466	446	443	386	335	341	321	228	145
California	1, 567	1, 498	1, 615	1, 814	1, 701	1, 499	1, 567	1, 355	1, 352	1, 451	1, 257	1, 068
Oregon and Washington	265	361	508	563	527	494	414	468	473	408	374	336
Puerto Rico	73	63	91	71	73	73	82	102	82	81	82	109
United States: 1943	8, 641	8, 656	10, 107	12, 757	12, 075	12, 702	12, 411	12, 587	12, 296	11, 288	8, 444	5, 603
1942 [1]	9, 115	8, 293	12, 563	14, 774	16, 349	18, 250	20, 501	21, 282	20, 148	20, 384	14, 653	8, 955

STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	4, 646	5, 227	5, 525	5, 316	4, 986	4, 445	4, 149	3, 894	3, 762	3, 923	3, 753	4, 142
New York and Maine	2, 230	2, 337	2, 152	2, 138	2, 180	2, 034	1, 915	1, 819	1, 701	1, 678	1, 895	2, 172
Ohio, western Pennsylvania, and West Virginia	2, 407	2, 638	2, 942	2, 973	3, 042	2, 976	2, 818	2, 519	2, 395	2, 422	2, 385	2, 577
Michigan	2, 321	2, 476	2, 586	2, 310	2, 537	2, 559	2, 453	2, 231	1, 949	1, 669	1, 691	1, 791
Wisconsin, Illinois, Indiana, and Kentucky	2, 247	2, 842	3, 196	3, 071	3, 000	2, 801	2, 667	2, 445	2, 336	2, 103	2, 293	2, 707
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	1, 191	1, 244	1, 449	1, 328	1, 186	1, 075	1, 204	1, 301	1, 294	1, 194	1, 235	1, 589
Eastern Missouri, Iowa, Minnesota, and South Dakota	2, 064	2, 346	2, 455	2, 320	2, 468	2, 450	2, 474	2, 364	1, 990	1, 832	2, 209	2, 483
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1, 036	866	817	615	937	1, 152	1, 246	1, 268	1, 262	1, 420	1, 611	2, 120
Texas	872	630	729	620	704	706	760	770	818	883	1, 010	1, 135
Colorado, Montana, Utah, Wyoming, and Idaho	440	455	380	272	274	221	244	263	304	351	387	407
California	1, 257	1, 321	1, 347	1, 213	1, 213	1, 311	1, 226	1, 359	1, 477	1, 625	1, 527	1, 557
Oregon and Washington	614	561	501	356	330	310	357	367	396	471	414	445
Puerto Rico	43	42	32	47	34	27	29	20	19	12	9	34
United States: 1943	21, 368	22, 985	24, 111	22, 579	22, 891	22, 067	21, 542	20, 620	19, 703	19, 583	20, 419	23, 159
1942[1]	23, 168	25, 668	25, 832	25, 112	24, 886	22, 609	18, 979	15, 268	12, 708	10, 624	12, 248	17, 428

[1] Figures include New Jersey (January to July, inclusive).

Stocks of finished cement at the end of 1942 were usually low but were replenished rapidly nearly to the customary operating level by March 31, 1943, from which they declined to the low for the year on October 31. They were rebuilt to about the usual level at the end of 1943. The increasing range of fluctuation in end-of-month stocks of finished portland cement and clinker from 1940 through 1942 was in sharp contrast to the usual trends in stocks. These wide variations and the return to more normal levels in 1943 are shown in figure 2. At the end of 1943, stocks of finished cement made under emergency alternate specifications may be termed high in the light of possible demand in 1944. The disposal of these stocks in an orderly manner represents the only prospective problem in adjusting the industry to post-war competitive markets for cement made under regular specifications.

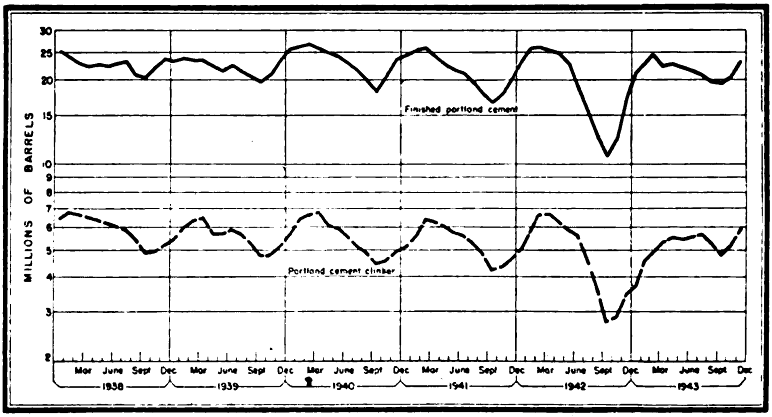

FIGURE 2.—Trends in end-of-month stocks of finished portland cement and portland-cement clinker, 1938–43.

Clinker stocks also were very low at the end of 1942 and were rebuilt more slowly than those of finished cement. They were replenished to an apparently satisfactory level by the end of May. It is noteworthy that stocks of clinker declined in only 3 months—June, September, and October—of 1943 and were highest on December 31.

Stocks of finished portland cement and portland-cement clinker at mills in the United States on December 31, and yearly range in end-of-month stocks, 1939–43

		Dec. 31 (barrels)	Range			
			Low		High	
			Month	Barrels	Month	Barrels
1939	Cement	23,645,583	October	19,870,000	February	24,092,000
	Clinker	5,165,000	November	4,824,000	April	6,568,000
1940	Cement	23,364,657	October	18,008,000	March	26,118,000
	Clinker	4,886,000	do	4,470,000	April	6,606,000
1941	Cement	19,964,918	do	16,417,000	March	25,988,000
	Clinker	4,575,000	do	4,192,000	do	6,276,000
1942	Cement	[1] 17,380,273	do	10,624,000	do	25,832,000
	Clinker	3,509,000	do	2,733,000	April	6,656,000
1943	Cement	23,172,202	do	19,583,000	March	24,111,000
	Clinker	5,959,000	January	3,771,000	December	5,959,000

[1] Revised figure.

DOMESTIC CONSUMPTION

Indicated consumption of portland cement in 1943 was above 1942 only in Delaware, North Carolina, Wyoming, and Idaho and was lower in all other States and the District of Columbia. The changes in regional consumption are illustrated in figure 1.

Destination of shipments of finished portland cement from mills in the United States, 1941–43, by States

Destination	1941 (barrels)	1942 (barrels)	1943	
			Barrels	Percent of change from 1942
Alabama	2,491,851	3,237,883	2,354,265	−27.3
Arizona [1]	793,838	1,379,825	997,273	−27.7
Arkansas	1,146,712	2,931,890	1,280,188	−56.3
California	16,850,718	17,444,451	13,157,805	−24.6
Colorado	1,520,646	2,204,461	951,031	−56.9
Connecticut [1]	2,379,471	1,996,198	1,094,609	−45.2
Delaware [1]	394,451	348,283	531,444	+52.6
District of Columbia [1]	1,590,499	1,566,360	1,314,305	−16.1
Florida	3,172,179	3,640,849	2,997,035	−17.7
Georgia	2,671,255	2,991,447	2,252,132	−24.7
Idaho	448,380	570,378	726,204	+27.3
Illinois	9,165,894	9,717,134	5,984,967	−38.4
Indiana	5,319,791	6,359,018	3,407,387	−46.4
Iowa	3,259,370	2,317,264	2,156,293	−6.9
Kansas	2,061,704	4,704,821	3,704,782	−21.3
Kentucky	2,705,374	2,613,180	1,836,249	−29.7
Louisiana	2,837,225	3,327,152	2,997,504	−9.9
Maine	623,245	559,731	439,647	−21.5
Maryland	3,093,522	3,036,945	2,620,319	−13.7
Massachusetts [1]	3,029,370	2,715,651	1,467,558	−46.0
Michigan	6,907,824	7,069,832	4,825,804	−31.7
Minnesota	3,035,480	2,320,780	1,533,605	−33.9
Mississippi [1]	1,407,063	1,467,849	784,009	−46.6
Missouri	5,029,976	3,877,208	2,543,024	−34.4
Montana	457,899	483,139	249,583	−48.3
Nebraska	1,380,339	4,519,493	2,589,611	−42.7
Nevada [1]	250,236	1,551,797	612,035	−60.6
New Hampshire [1]	518,691	456,845	268,157	−41.3
New Jersey [1]	5,353,149	5,149,525	3,435,432	−33.3
New Mexico [1]	749,023	696,841	463,833	−33.4
New York	14,096,501	12,139,320	5,931,517	−51.1
North Carolina [1]	2,574,455	2,420,086	3,197,208	+32.1
North Dakota [1]	361,416	291,977	268,290	−8.1
Ohio	8,455,877	8,160,031	6,384,002	−21.8
Oklahoma	2,131,784	3,218,926	3,080,350	−4.3
Oregon	1,529,971	1,350,988	1,008,276	−25.4
Pennsylvania	10,000,181	10,157,308	6,512,285	−35.9
Rhode Island [1]	834,261	963,073	535,352	−44.4
South Carolina [1]	1,759,468	1,927,768	1,048,924	−45.6
South Dakota	432,431	1,055,170	669,736	−36.5
Tennessee	4,281,918	5,282,485	3,002,112	−43.2
Texas	8,598,148	11,401,189	7,263,664	−36.3
Utah	1,196,451	1,997,820	1,453,948	−27.2
Vermont [1]	238,436	126,412	117,981	−6.7
Virginia	4,771,954	6,435,358	3,495,801	−45.7
Washington	3,015,298	4,266,440	3,700,222	−13.3
West Virginia	1,690,142	1,481,319	1,190,635	−19.6
Wisconsin	3,187,293	3,056,916	1,801,872	−69.7
Wyoming	284,771	378,704	383,511	+1.3
Unspecified	249,799	17,918	36,319	+102.7
Continental United States	160,335,730	177,385,438	120,658,095	−32.0
Outside continental United States [2]	7,103,507	7,915,446	6,973,764	−11.9
Total shipped from cement plants	167,439,237	185,300,884	127,631,859	−31.1

[1] Non-cement-producing State.

[2] Direct shipments by producers to foreign countries and to noncontiguous Territories (Alaska, Hawaii, Puerto Rico, etc.) including distribution from Puerto Rican mills.

Destination of shipments of finished portland cement from mills in the United States in 1943, by months, in barrels

Destination	January	February	March	April	May	June	July	August	September	October	November	December
Alabama	185,060	196,148	168,175	243,326	260,555	285,455	190,570	205,354	207,926	191,521	150,454	73,884
Arizona	61,394	86,913	97,037	91,171	116,193	95,809	89,814	94,974	116,303	80,903	34,665	35,531
Arkansas	124,748	138,252	114,744	132,844	67,874	108,884	121,701	103,571	83,995	84,624	110,172	80,647
California	1,058,600	1,031,370	1,189,711	1,203,476	1,192,570	1,078,344	1,039,263	1,070,830	1,031,224	1,136,559	1,096,049	894,624
Colorado	38,347	41,959	50,087	67,310	65,809	151,118	153,905	103,637	86,376	101,508	58,258	33,951
Connecticut	39,433	30,529	60,775	90,527	106,863	121,440	128,664	132,236	128,341	114,310	89,141	50,963
Delaware	24,887	29,328	38,645	68,921	72,450	96,139	68,515	54,930	22,190	16,882	25,478	12,752
District of Columbia	172,072	84,909	143,361	163,067	110,521	108,710	107,559	100,762	87,615	87,291	84,453	63,861
Florida	274,602	244,432	297,905	277,203	247,907	286,026	300,918	255,776	283,550	225,589	169,577	133,008
Georgia	274,927	302,359	257,795	271,062	184,764	179,775	172.197	180,159	135,615	119,351	95,913	78,141
Idaho	13,932	26,248	54,485	152,631	184,540	64,829	57,469	43,055	32,241	38,174	42,428	16,401
Illinois	274,738	291,869	325,204	480,269	436,752	695.537	709,642	805,929	800,702	604,965	353,781	204,915
Indiana	175,582	195,502	240,473	318,734	276,618	350.688	401,464	399,467	367,435	355,931	210,226	116,703
Iowa	16,101	26,569	70,940	200,593	238,646	237,301	170,214	270.953	482,487	346,531	64,429	31,325
Kansas	337,911	441,809	595,808	527,654	372,600	222,209	201,084	275,123	279,920	216,355	148,581	80,029
Kentucky	76,386	66,895	127,541	155,599	147,739	155,530	189,450	197,875	149,341	208,620	171,077	235,411
Louisiana	178,768	228,868	249,167	293,321	315,603	363,078	381,847	323,643	160,890	164,029	167,028	128,126
Maine	12,213	14,783	23,953	34,640	45,693	69,140	71,909	61,067	50,311	27,336	23,464	11,158
Maryland	148,782	119,110	198,368	270,445	264,626	291,401	313,603	310,651	225,794	189,212	178,943	105,992
Massachusetts	59,357	63,543	93,592	121,614	157,440	193,822	181,721	153,345	148,073	132,033	96,679	63,375
Michigan	171,254	177,794	221,646	378,515	457,461	535,420	518,799	602,173	605,010	584,771	385,081	187,077
Minnesota	16,807	18,219	36,997	124,576	149,523	205,228	167,220	201,325	261,082	266,038	56,464	20,621
Mississippi	81,526	76,629	84,345	100,534	87,640	65,764	56,998	57,501	37,209	51,616	50,490	33,145
Missouri	140,824	180,134	194,172	227,888	199,947	256,607	290,211	264,507	250,756	248,227	200,146	89,227
Montana	4,700	6,212	12,599	21,293	18,774	21,144	23,749	28,498	39,912	38,700	17,660	15,111
Nebraska	116,527	129,735	283,563	794,887	428,108	126,669	119,840	136,803	240,416	119,478	55,169	36,945
Nevada	84,615	59,060	84,446	42,802	26,074	27,416	14,030	13.782	43,637	174,180	28,359	13,650
New Hampshire	13,518	12,145	14,614	22,415	42,910	40,404	21,040	22,772	25,658	27,916	15,930	8,555
New Jersey	182,963	185,011	264,539	323,040	337,965	358,447	351,482	316,981	329,158	290,610	317,354	177,737
New Mexico	42,520	47,621	42,411	29,566	28,172	45,829	42,130	49,038	37.430	34,180	49,827	14,989
New York	256,148	187,178	368,465	502,921	560,529	670,396	654,891	754,653	802,415	623,983	355,823	190,961
North Carolina	229,751	213,160	183,630	256,295	306,328	314,889	342,942	308,279	317,023	354,360	263,673	105,168
North Dakota	2,632	661	4,262	18,780	26,862	55,048	48,542	30,263	28,826	42,729	11,036	3,033
Ohio	265,363	270,061	377,913	522,840	529,571	709,996	762,903	810,667	729,042	662,111	493,497	256,342
Oklahoma	354,362	414,054	297,827	368,791	168,019	223,360	298,948	257,758	232,688	193,283	193,874	79,381
Oregon	44,903	66,351	85,679	105,241	103,650	99,886	87,597	85,249	85,747	73,910	95,788	74,060
Pennsylvania	375,770	347,215	543,232	598,867	596,219	682,942	696,937	748,328	676,674	527,924	440,774	265,731
Rhode Island	43,156	40,030	50,790	59,059	71,556	58,503	51,304	47,509	38,704	34,722	25,501	15,038
South Carolina	197,961	69,360	51,903	71,658	69,347	84,448	49,848	92,000	111,564	125,970	74,546	48,792
South Dakota	3,614	5,799	15,324	45,515	68,948	177,002	209,972	30,124	44,228	47,873	12,202	9,028
Tennessee	444,567	353,093	254,445	285,955	286,446	217,077	191,772	206,359	190,694	224,272	206,075	141,383
Texas	539,184	745,923	707,614	732,636	667,438	666,003	528,130	645,677	597,027	602,480	495,456	335,277
Utah	100,235	121,402	135,160	160,027	149,621	114,530	129,995	124,104	127,167	122,526	106,939	64,818
Vermont	1,469	1,734	2,382	9,173	10,982	12,100	13,634	18,163	19,292	18,864	9,032	1,139
Virginia	297,419	285,467	330,266	391,368	375,233	386,370	308,612	330,748	236,841	228,053	197,697	126,361
Washington	194,275	263,298	373,685	412,484	400,930	397,097	293,909	365,497	387,605	324,795	269,569	259,304

West Virginia	61,952	64,000	82,226	95,166	126,069	133,809	131,649	120,595	134,435	113,177	83,231	43,464
Wisconsin	25,714	36,970	62,256	147,124	155,071	213,627	160,389	263,296	285,875	294,252	111,996	59,063
Wyoming	5,824	10,937	13,001	9,181	51,221	76,435	20,191	24,702	65,562	52,988	26,709	13,208
Unspecified	5,438		9,442	2,855	123,840		2,792		1,874	4,497	23,748	10,963
Continental United States	7,852,831	8,050,648	9,586,600	12,025,859	11,490,217	12,131,681	11,641,965	12,100,688	11,863,880	10,950,209	8,044,442	5,159,368
Outside continental United States [1]	788,169	605,352	520,400	731,141	584,783	570,319	769,035	486,312	432,120	337,791	399,558	443,632
Total	8,641,000	8,656,000	10,107,000	12,757,000	12,075,000	12,702,000	12,411,000	12,587,000	12,296,000	11,288,000	8,444,000	5,603,000

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[1] Shipments by producers to foreign countries and to noncontiguous Territories of the United States (Alaska, Hawaii, Puerto Rico, etc.) including distribution from Puerto Rican mills.

LOCAL SUPPLIES

Local supplies of portland cement listed in the following table do not indicate areas or States in which a definite shortage of cement existed, because parts of any area or State commonly are supplied from mills of a neighboring State within normal shipping range. The total surplus of producing States in 1943 was distributed as follows: 16,136,410 barrels to non-cement-producing States, 5,948,844 barrels to destinations outside continental United States (excluding local consumption of Puerto Rican production), and 36,319 barrels to unspecified destinations.

Estimated surplus or deficiency in local supply of portland cement in cement-producing States, 1942–43, in barrels

State or division	1942			1943		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	8, 598, 332	3, 237, 883	+5, 360, 449	7, 368, 567	2, 354, 265	+5, 014, 302
California	23, 787, 808	17, 444, 451	+6, 343, 357	17, 806, 731	13, 157, 805	+4, 648, 926
Illinois	7, 102, 393	9, 717, 134	−2, 614, 741	4, 307, 278	5, 984, 967	−1, 677, 689
Iowa	5, 662, 733	2, 317, 264	+3, 345, 469	3, 912, 307	2, 156, 293	+1, 756, 014
Kansas	7, 726, 291	4, 704, 821	+3, 021, 470	5, 305, 798	3, 704, 782	+1, 601, 016
Michigan	10, 349, 104	7, 069, 832	+3, 279, 272	6, 430, 404	4, 825, 804	+1, 604, 600
Missouri	7, 397, 960	3, 877, 208	+3, 520, 752	4, 464, 943	2, 543, 024	+1, 921, 919
Ohio	8, 652, 196	8, 160, 031	+492, 165	6, 096, 187	6, 384, 002	−287, 815
Pennsylvania	33, 639, 025	10, 157, 308	+23, 481, 717	19, 551, 388	6, 512, 285	+13, 039, 103
Puerto Rico	629, 358	1, 002, 412	−373, 054	982, 087	1, 024, 920	−42, 833
Tennessee	6, 407, 196	5, 282, 485	+1, 124, 711	4, 579, 526	3, 002, 112	+1, 577, 414
Texas	12, 139, 800	11, 401, 189	+738, 611	9, 177, 392	7, 263, 664	+1, 913, 728
Colorado, Montana, Utah, Wyoming, and Idaho	4, 588, 428	5, 634, 502	−1, 046, 074	3, 788, 859	3, 764, 277	+24, 582
Oregon and Washington	5, 940, 938	5, 617, 428	+323, 510	5, 190, 882	4, 708, 498	+482, 384
Georgia, Kentucky, Virginia, Florida, and Louisiana	8, 074, 555	19, 007, 986	−10, 933, 431	7, 272, 478	13, 578, 721	−6, 306, 243
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas	18, 137, 387	23, 462, 193	−5, 324, 806	11, 554, 774	14, 362, 749	−2, 807, 975
Maryland, New Jersey, and West Virginia[1]	4, 822, 553	9, 667, 789	−4, 845, 236	3, 501, 524	3, 810, 954	−309, 430
New York and Maine	11, 644, 827	12, 609, 051	−1, 054, 224	6, 340, 734	6, 371, 164	−30, 430
	185, 300, 884	160, 460, 967	+24, 839, 917	127, 631, 859	105, 510, 286	+22, 121, 573

[1] Does not include New Jersey for 1943; production and shipments were discontinued July 1942.

TRANSPORTATION

The proportional use of transportation facilities by the portland-cement industry in 1943 changed somewhat from 1942 and was nearly the same as in 1941, the last peacetime year. Railroads transported 83 percent of total cement shipments in 1943 compared with 85 percent in 1942 and 82 percent in 1941. Despite continued gasoline and tire rationing, the percentage moved by truck increased from 13 in 1942 to 15 in 1943. The shrinkage of cement markets under war restrictions and the conversion of many bulk-cement railroad cars to transporting other materials in 1943 undoubtedly were factors in the decreased proportions shipped by rail and the increased proportions moved by truck. The percentage of total shipments moved by boat was slightly higher than in 1942 and slightly lower than in 1941.

The proportions of total shipments moved in cloth and paper containers changed sharply in 1943 from 1942, although the aggregate percentage shipped in containers was unchanged. Paper bags were used for 36 percent of total shipments in 1943 compared with 31 percent in 1942, whereas cloth bags were used for only 22 percent in 1943 compared with 26 percent in 1942. Makers of new cloth and paper bags were limited by the War Production Board in 1943 to the manufacture of only one size of bag—94 pounds net weight—for portland cement. Although the proportion of total shipments moved in bulk was unchanged, the facilities used to transport bulk cement showed marked differences from 1942. The proportions of bulk shipments moved by truck in 1943 increased nearly 3 percent and by rail declined slightly more than 3 percent from the corresponding proportions in 1942.

Shipments of portland cement from mills in the United States, 1941–43, in bulk and in containers, by types of carriers

[Barrels of 376 pounds]

Type of carrier	In bulk		In containers				Total shipments	
			Bags		Other containers [1]	Total		
			Paper	Cloth				
	Barrels	*Percent*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Percent*
1941 [2]								
Truck	[3] 5,481,732	10.6	9,989,551	9,310,998		19,300,549	24,782,281	14.8
Railroad	44,641,936	86.1	53,863,493	39,506,899	31,141	93,401,533	138,043,469	82.4
Boat	1,559,678	3.0	2,414,842	496,452	150	2,911,444	4,471,122	2.7
Pipe line	142,365	.3					142,365	.1
	51,825,711	100.0	66,267,886	49,314,349	31,291	115,613,526	167,439,237	100.0
Percent of total	31.0		39.6	29.4	(4)	69.0	100.0	
1942 [2]								
Truck	[3] 8,925,440	11.5	8,206,616	6,306,601		14,513,217	23,438,657	12.6
Railroad	66,764,363	85.8	49,385,586	42,440,744	8,666	91,834,996	158,599,359	85.6
Boat	2,097,849	2.7	690,341	474,678		1,165,019	3,262,868	1.8
	77,787,652	100.0	58,282,543	49,222,023	8,666	107,513,232	185,300,884	100.0
Percent of total	42.0		31.4	26.6	(4)	58.0	100.0	
1943 [2]								
Truck	[3] 7,744,131	14.4	7,595,623	3,170,639		10,766,262	18,510,393	14.5
Railroad	44,452,539	82.6	37,688,106	24,345,755	18,513	62,052,374	106,504,913	83.4
Boat	1,622,923	3.0	849,969	143,661		993,630	2,616,553	2.1
	53,819,593	100.0	46,133,698	27,660,055	18,513	73,812,266	127,631,859	100.0
Percent of total	42.2		36.1	21.7	(4)	57.8	100.0	

[1] Includes steel drums and iron and wood barrels.

[2] Includes shipments for Puerto Rico.

[3] Includes cement used at mills by producers as follows—1941: 196,765 barrels; 1942: 181,642 barrels; 1943: 153,337 barrels.

[4] Less than 0.05 percent.

MILL VALUES

The average net mill realization of all portland cement shipped from mills in 1943 advanced to $1.57 per barrel from $1.53 in 1942. Much of this gain in average mill value may be ascribed to the increased proportion of shipments of the relatively higher-valued high-early-strength, white, and oil-well cements, which represented 6 percent of total shipments in 1943 compared with 4 percent in 1942. Another contributing factor was less freight absorption in 1943 owing to the narrowing of cement markets, which were restricted by the haulage conservation orders and by the limitations of the maximum price regulation on sales outside the normal shipping area of a mill. Moreover, the selling prices on some long-term contracts did not expire until late in 1942 or early in 1943 and were below the permitted maximum prices.

The composite wholesale price of portland cement, f. o. b. destination, declined slightly from 1942 according to the Bureau of Labor Statistics index (1926=100), which was 93.8 in 1943 and 94.0 in 1942.

Average mill value per barrel, in bulk, of portland cement in the United States, 1939–43

1939	$1.47	1942	$1.53
1940	1.46	1943	1.57
1941	1.47		

CAPACITY OF PLANTS

The aggregate annual capacity of all portland-cement plants declined about 6¼ million barrels in 1943 from 1942, owing principally to the closing and dismantling of several mills. The new capacity formula set up by the Bureau of Mines for the 1943 canvass also tended to reduce the reported capacities. Data for 1943 include figures on 153 active mills. The over-all rate of operations in 1943 was at 55 percent of total capacity. In general, plant activity was appreciably higher in the Southern States and in States west of the Mississippi River than in the remainder of the country.

Portland-cement-manufacturing capacity of the United States, 1942–43, by producing districts

District	Estimated capacity (barrels)		Percent of capacity utilized	
	1942	1943	1942	1943
Eastern Pennsylvania, New Jersey, and Maryland [1]	45,554,000	42,879,516	69.2	42.7
New York and Maine	17,626,000	16,944,909	66.4	38.9
Ohio, western Pennsylvania, and West Virginia	26,243,000	25,666,236	59.3	44.5
Michigan	14,055,000	13,243,920	75.5	47.2
Wisconsin, Illinois, Indiana, and Kentucky	28,662,000	27,996,310	65.0	44.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	24,612,870	24,054,147	88.6	78.4
Eastern Missouri, Iowa, Minnesota, and South Dakota	20,936,622	19,471,557	61.3	50.5
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	16,915,000	16,419,795	81.1	72.2
Texas	13,200,154	14,180,000	91.9	67.6
Colorado, Montana, Utah, Wyoming, and Idaho	5,925,000	5,450,000	73.8	71.1
California	27,071,302	27,390,000	86.3	67.4
Oregon and Washington	7,440,000	7,363,288	78.8	69.1
Puerto Rico	610,000	1,400,000	109.3	70.0
	248,850,948	242,459,678	73.5	55.0

[1] Does not include New Jersey for 1943; production was discontinued July 1942.

The distribution of cement plants according to annual capacity differed considerably in 1943 from 1942. The number of plants with capacity under 1,000,000 barrels on December 31, 1943, increased to 44 compared with 37 in 1942, whereas the number in each of the other groups decreased.

The percentage of capacity used in each month of 1943 except in January was lower than in the corresponding month of 1942. The monthly rate of operations in 1943 was highest in January and lowest in December.

Distribution of portland-cement plants in the United States in 1943, according to annual capacity

Estimated annual capacity, barrels:	*Number of plants*
Less than 1,000,000	44
1,000,000 to 1,999,000	78
2,000,000 to 2,999,000	21
Between 2,999,000 and 10,000,000	10
	153

Percent of capacity used in the finished portland-cement industry in the United States, 1942-43

Month	Monthly		12 months ended—		Month	Monthly		12 months ended—	
	1942	1943	1942	1943		1942	1943	1942	1943
January	59	60	67	74	July	80	56	71	67
February	57	54	69	74	August	85	56	73	64
March	61	54	69	73	September	87	56	73	62
April	69	55	70	72	October	87	53	73	59
May	77	59	71	70	November	80	46	74	56
June	79	58	71	69	December	67	40	74	54

With completion of a new wet-process mill, the total capacity of wet plants exceeded that of dry plants in 1943 for the first time. As in recent years, the wet-process capacity was utilitzed more fully than the dry-process capacity.

Capacity of portland-cement plants in the United States, 1941-43, by processes

Process	Capacity						Percent of capacity utilized			Percent of total finished cement produced		
	Thousands of barrels			Percent of total								
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
Wet	121,065	122,432	122,702	48.9	49.2	50.6	70.3	77.7	59.5	51.9	52.1	54.7
Dry	126,294	126,419	119,758	51.1	50.8	49.4	62.5	69.3	50.4	48.1	47.9	45.3
	247,359	248,851	242,460	100.0	100.0	100.0	66.3	73.5	55.0	100.0	100.0	100.0

CLINKER PRODUCTION

Production of clinker, the intermediate product of the industry, was 25 percent below 1942. Stocks at mills on December 31, 1943, were at a satisfactory operating level and were 70 percent above the unusually low quantity on hand at the end of 1942.

Production and stocks of portland-cement clinker at mills in the United States in 1943, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania and Maryland	1,926	1,796	1,841	1,536	1,497	1,371	1,488	1,630	1,443	1,451	1,187	1,165
New York and Maine	727	379	263	471	646	548	638	621	603	568	542	540
Ohio, western Pennsylvania, and West Virginia	963	829	1,051	952	1,092	1,037	1,054	978	922	971	889	691
Michigan	580	396	461	501	724	763	677	614	543	588	560	427
Wisconsin, Illinois, Indiana, and Kentucky	1,383	1,232	1,140	968	932	983	1,102	1,055	994	847	890	846
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	1,714	1,631	1,767	1,594	1,690	1,564	1,704	1,700	1,550	1,516	1,348	1,399
Eastern Missouri, Iowa, Minneota, and South Dakota	974	659	654	839	1,007	933	892	897	827	803	706	604
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1,090	881	1,024	1,205	1,228	1,118	1,021	1,010	919	813	875	796
Texas	790	749	884	871	947	859	889	888	729	742	692	638
Colorado, Montana, Utah, Wyoming, and Idaho	290	246	274	367	385	412	426	349	378	396	279	126
California	1,964	1,769	1,876	1,798	1,836	1,705	1,569	1,535	1,507	1,471	1,323	1,237
Oregon and Washington	322	361	395	412	524	443	466	482	443	472	346	429
Puerto Rico	85	58	78	89	82	60	48	86	78	78	88	107
United States: 1943	12,808	10,986	11,708	11,603	12,590	11,796	11,974	11,845	10,936	10,716	9,725	9,005
1942[1]	12,753	11,627	13,419	14,117	15,668	15,541	16,504	16,565	16,594	17,341	16,358	14,781
STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	708	860	938	905	854	798	739	794	758	643	738	835
New York and Maine	325	353	425	403	402	339	316	280	250	256	249	297
Ohio, western Pennsylvania, and West Virginia	436	540	567	572	613	563	549	509	382	297	403	437
Michigan	280	327	406	691	608	629	683	662	639	670	708	807
Wisconsin, Illinois, Indiana, and Kentucky	411	452	481	503	584	551	558	523	356	331	379	390
Virginia, Tennessee, Alabama, Georgia, Louisiana, and Florida	305	385	468	437	543	455	424	407	433	424	421	582
Eastern Missouri, Iowa, Minnesota, and South Dakota	262	249	270	323	324	338	334	419	405	366	299	318
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	206	234	178	180	202	267	308	342	335	238	309	293
Texas	123	188	78	89	112	106	163	232	231	186	149	254
Colorado, Montana, Utah, Wyoming, and Idaho	42	50	104	113	51	73	91	76	73	93	120	82
California	501	705	838	920	1,055	1,143	1,234	1,268	1,271	1,160	1,307	1,454
Oregon and Washington	128	184	136	135	162	135	145	156	101	95	116	197
Puerto Rico	44	39	37	41	64	58	24	20	19	25	35	13
United States: 1943	3,771	4,566	4,926	5,312	5,574	5,455	5,568	5,688	5,253	4,784	5,233	5,959
1942[1]	5,020	5,840	6,571	6,656	6,241	5,809	5,528	4,493	3,606	2,733	2,840	3,509

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[1] Figures include New Jersey (January to July, inclusive).

Portland-cement clinker produced and in stock at mills in the United States, 1942–43, by processes, in barrels of 376 pounds [1]

Process	Plants		Production		Stock (Dec. 31)	
	1942	1943	1942	1943	1942	1943
Wet	[2] 89	86	93, 817, 195	73, 438, 854	1, 722, 266	2, 457, 848
Dry	65	63	87, 450, 266	62, 253, 546	1, 787, 070	3, 501, 322
	[2] 154	149	181, 267, 461	135, 692, 400	3, 509, 336	5, 959, 170

[1] Compiled from monthly estimates of the producers.
[2] Revised figures.

PRODUCTION ACCORDING TO RAW MATERIALS

Portland-cement plants using cement rock and limestone as raw materials supplied only 22 percent of the total production in 1943 compared with 27 percent in 1942. This decline in relative importance of the cement-rock and limestone mixture may be attributed to the lower activity of mills in the northeastern section of the country where these rocks are the principal raw materials. Mixtures of limestone and clay or shale are the predominant raw materials employed in southern and western mills, and as these mills were relatively more active in 1943 the percentage of total output made from these raw materials increased to 69 from 63 in 1942. The proportion of the 1943 production made from the marl-clay mixture was unchanged and for the slag-limestone mixture declined slightly from 1942.

Production and percentage of total output of portland cement in the United States, 1898–1914, 1926, 1929, 1933, 1935, 1941, 1942, and 1943, according to raw materials

Year	Cement rock and pure limestone		Limestone and clay or shale		Marl and clay		Blast-furnace slag and limestone	
	Barrels	Percent	Barrels	Percent	Barrels	Percent	Barrels	Percent
1898	2, 764, 694	74. 9	365, 408	9. 9	562, 092	15. 2	------------	--------
1899	4, 010, 132	70. 9	546, 200	9. 7	1, 095, 934	19. 4	------------	--------
1900	5, 960, 739	70. 3	1, 034, 041	12. 2	1, 454, 797	17. 1	32, 443	0. 4
1901	8, 503, 500	66. 9	2, 042, 209	16. 1	2, 001, 200	15. 7	164, 316	1. 3
1902	10, 953, 178	63. 6	3, 738, 303	21. 7	2, 220, 453	12. 9	318, 710	1. 8
1903	12, 493, 694	55. 9	6, 333, 403	28. 3	3, 052, 946	13. 7	462, 930	2. 1
1904	15, 173, 391	57. 2	7, 526, 323	28. 4	3, 332, 873	12. 6	473, 294	1. 8
1905	18, 454, 902	52. 4	11, 172, 389	31. 7	3, 884, 178	11. 0	1, 735, 343	4. 9
1906	23, 896, 951	51. 4	16, 532, 212	35. 6	3, 958, 201	8. 5	2, 076, 000	4. 5
1907	25, 859, 095	53. 0	17, 190, 697	35. 2	3, 606, 598	7. 4	2, 129, 000	4. 4
1908	20, 678, 693	40. 6	23, 047, 707	45. 0	2, 811, 212	5. 5	4, 535. 300	8. 9
1909	24, 274, 047	37. 3	32, 219, 365	49. 6	2, 711, 219	4. 2	5, 786, 800	8. 9
1910	26, 520, 911	34. 6	39, 720, 320	51. 9	3, 307, 220	4. 3	7, 001, 500	9. 2
1911	26, 812. 129	34. 1	40, 665, 332	51. 8	3, 314, 176	4. 2	7, 737, 000	9. 9
1912	24, 712, 780	30. 0	44, 607, 776	54. 1	2, 467, 368	3. 0	10, 650, 172	12. 9
1913	29, 333, 490	31. 8	47, 831, 863	51. 9	3, 734, 778	4. 1	11, 197, 000	12. 2
1914	24, 907, 047	28. 2	50, 168, 813	56. 9	4, 038, 310	4. 6	9, 116, 000	10. 3
1926	44, 090, 657	26. 8	[1] 101, 637, 866	61. 8	3, 324, 408	2. 0	15, 477, 239	9. 4
1929	51, 077, 034	29. 9	[1] 97, 623, 502	57. 2	4, 832, 700	2. 9	17, 112, 800	10. 0
1933	14, 135, 171	22. 3	[1] 43, 638, 023	68. 7	1, 402, 744	2. 2	4, 297, 251	6. 8
1935	23, 811, 687	31. 0	[1] 45, 073, 144	58. 8	1, 478, 569	1. 9	6, 378, 170	8. 3
1941	46, 534, 193	28. 4	[1] 102, 285, 699	62. 3	3, 142, 021	1. 9	12, 068, 646	7. 4
1942	49, 479, 304	27. 0	[1] 115, 948, 373	63. 4	3, 009, 562	1. 7	14, 343, 945	7. 9
1943	29, 915, 157	22. 4	[1] 92, 310, 018	69. 2	2, 300, 636	1. 7	8, 897, 977	6. 7

[1] Includes output of 2 plants using oystershells and clay in 1926; 3 plants in 1929, 1933, and 1935; and 4 plants in 1941, 1942, and 1943.

RAW MATERIALS

The tonnages of raw materials required for the 1943 output of finished portland cement are listed in the following table.

Raw materials used in producing portland cement in the United States, 1941–43

	1941	1942	1943
	Short tons	*Short tons*	*Short tons*
Cement rock	12,593,385	13,538,358	8,564,458
Limestone [1]	31,957,951	36,198,156	28,598,436
Marl	1,066,635	903,360	699,456
Clay and shale [2]	4,726,842	5,181,757	4,004,316
Blast-furnace slag	659,201	809,371	544,084
Gypsum	1,035,179	1,248,448	850,660
Sand and sandstone [3]	430,248	567,689	350,941
Iron materials [4]	227,968	252,200	188,096
Miscellaneous [5]	57,844	159,104	38,542
Total	52,755,253	58,858,443	43,838,989
	Pounds	*Pounds*	*Pounds*
Average total weight required per barrel (376 pounds) of finished cement	643	644	657

[1] Includes oystershells.
[2] Includes bentonite, diatomaceous shale, and fuller's earth.
[3] Includes silica and quartz.
[4] Includes iron ore, pyrite cinders and ore, and mill scale.
[5] Includes diatomite, fluorspar, pumicite, flue dust, pitch, red mud and rock, hydrated lime, tufa, cinders calcium chloride, sludge, grinding aids, and air-entraining compound.

FUELS AND POWER

Several kilns in Kansas were converted from gas to coal or oil firing to forestall any prospective fuel shortages. At times in 1943, cement production in some Pacific Northwest plants was curtailed owing to difficulties in obtaining fuel supplies.

Finished portland cement produced and fuel consumed by the portland-cement industry in the United States, 1942–43, by processes

Process	Finished cement produced			Fuel consumed [1]		
	Plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (cubic feet)
1942						
Wet	[2] 89	95,171,022	52.1	[3] 3,637,571	1,896,044	40,850,105,348
Dry	65	87,610,162	47.9	3,932,516	1,532,975	23,689,722,940
	[2] 154	182,781,184	100.0	[4] 7,570,087	3,429,019	64,539,828,288
1943						
Wet	86	73,019,416	54.7	2,957,055	1,397,442	34,720,918,557
Dry	63	60,404,372	45.3	2,894,368	1,554,720	17,026,806,000
	149	133,423,788	100.0	[5] 5,851,423	2,952,162	51,747,724,557

[1] Figures compiled from monthly estimates of the producers.
[2] Revised figures.
[3] In addition to the coal shown for this group, 1 plant reported the use of petroleum coke with coal and natural gas.
[4] Includes 107,653 short tons of anthracite and 7,462,434 short tons of bituminous coal.
[5] Includes 8,539 short tons of anthracite and 5,842,884 short tons of bituminous coal.

Portland cement produced in the United States, 1942–43, by kinds of fuel

Fuel	Finished cement produced			Fuel consumed [1]		
	Number of plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (cubic feet)
1942						
Coal	[2] 97	[2] 107,168,837	58.6	6,329,228		
Oil	12	[2] 12,893,278	7.1		2,820,520	
Natural gas	12	[2] 15,103,415	8.3			21,641,045,940
Coal and oil	[2] 8	14,938,889	8.2	971,619	250,711	
Coal and natural gas [4]	[2] 14	14,443,714	7.9	260,153		18,585,083,957
Oil and natural gas	7	13,269,603	7.2		304,190	17,348,363,000
Coal, oil, and natural gas	4	4,963,448	2.7	9,087	53,598	6,965,335,391
	[2] 154	182,781,184	100.0	[5] 7,570,087	3,429,019	64,539,828,288
1943						
Coal	89	[2] 72,745,601	54.5	4,665,946		
Oil	13	[2] 10,121,934	7.6		2,471,517	
Natural gas	11	[2] 10,255,676	7.7			15,179,874,200
Coal and oil	10	10,108,735	7.6	697,989	50,907	
Coal and natural gas	14	12,889,090	9.7	326,618		15,269,282,100
Oil and natural gas	7	11,904,336	8.9		260,364	15,388,933,857
Coal, oil, and natural gas	5	5,398,416	4.0	161,870	169,374	5,909,634,400
	149	133,423,788	100.0	[6] 5,851,423	2,952,162	51,747,724,557

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[1] Figures compiled from monthly estimates of the producers.

[2] Revised figures.

[3] Average consumption of fuel per barrel of cement produced was as follows: 1942—Coal, 118.1 pounds; oil, 0.2188 barrel; natural gas, 1,433 cubic feet. 1943—Coal, 128.3 pounds; oil, 0.2442 barrel; natural gas, 1,480 cubic feet.

[4] In addition to the coal and natural gas included for this group, 1 plant reported the use of petroleum coke with coal and natural gas.

[5] Includes 107,653 short tons of anthracite and 7,462,434 short tons of bituminous coal.

[6] Includes 8,539 short tons of anthracite and 5,842,884 short tons of bituminous coal.

Electric energy used at portland-cement-producing plants in the United States, 1942–43, by processes, in kilowatt-hours

Process	Electric energy used						Finished cement produced (barrels)	Average electric energy used per barrel of cement produced (kilowatt-hours)
	Generated at portland-cement plants		Purchased		Total			
	Active plants	Kilowatt-hours	Active plants	Kilowatt-hours	Kilowatt-hours	Percent		
1942								
Wet	31	656,101,658	76	1,370,871,010	2,026,972,668	50.6	95,171,022	21.3
Dry	35	1,229,365,051	52	752,007,188	1,981,372,239	49.4	87,610,162	22.6
	66	1,885,466,709	128	2,122,878,198	4,008,344,907	100.0	182,781,184	21.9
Percent of total electric energy used		47.0		53.0	100.0			
1943								
Wet	30	562,003,714	74	1,358,769,419	1,920,773,133	56.6	73,019,416	26.3
Dry	34	910,805,458	51	559,848,279	1,470,653,737	43.4	60,404,372	24.3
	64	1,472,809,172	125	1,918,617,698	3,391,426,870	100.0	133,423,788	25.4
Percent of total electric energy used		43.4		56.6	100.0			

TYPES OF CEMENT

A complete break-down of total production of portland cement in 1943 into the various types is presented in the following table. The general-use and moderate-heat types are combined because separate records are not kept at a number of plants where mill-run cement will pass specifications for both types, and no differential is made in the selling price of either type. In 1943 demand fell for all types of cement except white.

Prepared masonry mortars.—Production of these mixed materials in 1943 from 54 plants totaled 1,993,862 barrels and shipments 1,914,060 barrels, valued at $2,962,367, an average mill realization of $1.55 per barrel. These data are not included in the statistics of this chapter, but the portland cement used in producing the mixtures is included.

Portland cement produced and shipped in the United States, 1939–43, by types

Kind and year	Active plants	Production (barrels)	Shipments		
			Barrels	Value	
				Total	Average
General use and moderate heat (types I and II):[1] 1943	153	123, 490, 667	118, 347, 297	$182,682,614	$1. 54
High-early-strength (type III):					
1939	79	3, 780, 716	3, 693, 460	6, 964, 608	1. 89
1940	88	4, 478, 797	4, 401, 449	8, 243, 315	1. 87
1941	90	6, 063, 638	6, 123, 224	11, 443, 792	1. 87
1942	87	7, 523, 647	7, 065, 700	13, 683, 665	1. 94
1943	95	6, 816, 671	6, 299, 190	12, 040, 467	1. 91
Low-heat (type IV):[1] 1943	4	1, 710, 617	1, 687, 277	2, 316, 755	1. 37
Sulfate-resisting (type V):					
1939	4	38, 279	27, 362	57, 867	2. 11
1940	11	193, 348	200, 090	316, 280	1. 58
1941	9	342, 400	353, 885	544, 767	1. 54
1942	8	79, 835	77, 015	136, 939	1. 78
1943	5	24, 419	20, 697	40, 933	1. 98
Oil-well:					
1939	12	375, 866	375, 027	710, 032	1. 89
1940	22	711, 348	719, 022	1, 365, 840	1. 90
1941	19	786, 167	806, 364	1, 550, 301	1. 92
1942	17	537, 541	552, 157	1, 100, 296	1. 99
1943	16	630, 412	544, 436	1, 050, 178	1. 93
White:					
1939	3	(2)	(2)	(2)	(2)
1940	3	(2)	(2)	(2)	(2)
1941	4	538, 752	549, 293	2, 191, 289	3. 99
1942	5	345, 613	306, 120	1, 214, 422	3. 97
1943	7	318, 470	335, 110	1, 340, 201	4. 00
Portland-puzzolan:					
1939	9	337, 187	321, 217	434, 281	1. 35
1940	10	413, 870	412, 143	552, 830	1. 34
1941	8	441, 500	439, 354	632, 713	1. 44
1942	7	324, 002	329, 637	465, 627	1. 41
1943	4	215, 026	221, 182	311, 230	1. 41
Miscellaneous:[3]					
1939	15	755, 833	775, 179	1, 067, 699	1. 38
1940	13	580, 502	577, 579	755, 764	1. 31
1941	14	668, 655	667, 206	1, 058, 108	1. 59
1942	12	242, 170	269, 705	468, 083	1. 74
1943	22	217, 506	176, 670	320, 838	1. 82

[1] Figures reported separately for the first time in 1943.

[2] Bureau of Mines not at liberty to publish figures separately.

[3] Includes hydroplastic and plastic portland cements, 1939–42, and hydroplastic, plastic, and waterproofed cements in 1943.

NEW DEVELOPMENTS

The outstanding plant development of 1943 was the start of production in the new wet-process plant[6] at Northampton, Pa. Flotation of raw materials is employed so that most types of gray cement may be made from rock of the plant quarry.

In 1943 construction was started on two plants designed to produce Bayer-grade alumina from domestic materials with a byproduct suitable for production of low-alumina cement. One plant (at Harleyville, S. C.) uses a lime-clay sinter and soda-leach process and will begin operating in 1944. The other (at Laramie, Wyo.) employs a lime-anorthosite-soda sinter and soda-leach process and will start producing in 1945.

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[6] Sprague, L. G., The New Cement Plant of the Universal Atlas Cement Co. at Northampton, Pa.; Am. Inst. Min. and Met. Eng., Tech. Pub. 1619, 1943, 10 pp.
Rockwood, Nathan C., World's Latest Cement Plant: Rock Products, vol. 46, No. 11, November 1943, pp. 43–81.
Trauffer, W. E., Universal Atlas' New Cement Plant at Northampton: Pit and Quarry, vol. 36, No. 5, November 1943, pp. 65–101.

Concomitant with the slump in demand for portland cement in 1943, producers became interested in utilizing plant equipment to make other materials needed in the war program. Six cement plants (one each in New York, Michigan, Wisconsin, Tennessee, Missouri, and Texas) were converted in part to the production of lime. Seven other plants (four in Pennsylvania, two in New York, and one in Minnesota) were converted partly to the nodulizing of iron-ore fines or sludge or flue dust for blast-furnace feed. Other conversions of cement equipment were for the production of defluorinated phosphate rock (one plant each in Pennsylvania and Illinois), sodium aluminate (one plant in Illinois), process materials for magnesium metal (one plant in Michigan), and flux and pulverized limestone (one plant in Alabama). In addition, the machine shop of a plant in Pennsylvania was converted entirely to production of war materials, and one plant in Michigan produced cement paints.

The findings of a fundamental electron-microscope study of the crystals resulting from the hydration of portland cement compounds and of portland cement were published.[7]

Investigations [8] on additions of eight materials to pastes of different portland-cement clinkers revealed that some materials caused large changes only in the early behavior of the pastes and that few of the substances had appreciable effects on tests at 28 days.

NATURAL, MASONRY (NATURAL), AND PUZZOLAN CEMENTS

Data on the group of hydraulic cements other than portland are presented in the following table. In 1943, producers reported consumption of 24,679 short tons of coal and of gas equivalent to 52 tons of coal.

Natural, masonry (natural), and puzzolan (slag-lime) cements produced, shipped, and in stock at mills in the United States, 1939–43

Year	Production		Shipments		Stock (Dec. 31)
	Active plants	Barrels (376 pounds)	Barrels (376 pounds)	Value	Barrels (376 pounds)
1939	12	2,439,110	2,405,135	$3,361,724	239,938
1940	12	2,534,566	2,514,597	3,386,801	259,868
1941	12	2,875,962	2,926,203	3,967,567	199,365
1942	11	2,560,425	2,508,324	3,668,169	[1] 253,307
1943	10	1,830,266	1,846,803	2,357,112	236,770

[1] Revised figure.

TRENDS IN EMPLOYMENT AND OUTPUT PER MAN[9]

The average number of men employed increased each year from 1938 through 1942, when output of finished cement set a new record.

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[7] Sliepcevich, C. M., Gildart, M., and Katz, D. L., Crystals from Portland Cement Hydration: Ind. and Eng. Chem., vol. 35, No. 11, November 1943, pp. 1178–1187.

[8] Newman, Edwin S., Blaine, Raymond L., Jumper, Charles S., and Kalousek, George L., Effects of Additions on Cement Clinker Pastes: Nat. Bureau of Standards Jour. Research, vol. 30, No. 4, April 1943, pp. 281–301.

[9] Statistics on employment and output per man presented in this discussion were compiled by D. I. Marsh from records of the Accident Analysis Division, Bureau of Mines.

Compared with 1928, the number of employees and man-hours worked in 1942 was appreciably lower, although the total production was greater. In 1942 a total of 29,768 employees averaged 7.5 hours per shift for 315 days and produced 2.59 barrels per man-hour; in 1928, the estimated total of 35,100 men averaged 9.5 hours per shift for 324 days and produced 1.63 barrels of cement per man-hour. The long-term increase in output per man-hour from 1928 to 1942 indicates the gain in plant efficiency that has resulted largely from mechanization. As would be expected from the continual modernization of plants and the increasing volume of annual production, output per man-hour increased each year from 1938 through 1942.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1938–42

Year	Employment					Production			Percent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1938	25,036	256	6,398,178	7.5	47,729,779	105,357,000	16.47	2.21	100.0
1939 [2]	25,503	273	6,974,191	7.3	51,184,194	121,934,911	17.48	2.38	[3] 100.0
1940 [2]	26,038	279	7,276,469	7.4	54,116,153	129,830,687	17.84	2.40	[3] 100.0
1941 [2]	28,409	303	8,600,572	7.4	63,636,617	163,567,931	19.02	2.57	100.0
1942 [2]	29,768	315	9,374,851	7.5	70,203,687	182,114,486	19.43	2.59	100.0

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.
[2] Exclusive of Puerto Rico.
[3] Revised.

MILL EMPLOYMENT

The number of men employed in mills represented 79 percent of total employment by the industry in 1942, and as they averaged 323 days of work they supplied 80 percent of the total man-hours.

Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1938–42

Year	Employment—cement mill only					Production			Percent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1938	19,828	264	5,224,790	7.4	38,866,410	105,357,000	20.16	2.71	100.0
1939 [2]	20,186	282	5,691,718	7.3	41,518,750	121,934,911	21.42	2.94	[3] 100.0
1940 [2]	20,692	287	5,930,723	7.4	43,967,729	129,830,687	21.89	2.95	[3] 100.0
1941 [2]	22,205	311	6,904,905	7.3	50,616,860	163,567,931	23.69	3.23	100.0
1942 [2]	23,492	323	7,589,439	7.4	56,345,160	182,114,486	24.00	3.23	100.0

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.
[2] Exclusive of Puerto Rico.
[3] Revised.

QUARRY AND CRUSHER EMPLOYMENT

The number of quarry and crusher employees was 17 percent of the total for the industry in 1942, but as they averaged 280 days employment they furnished 16 percent of the total man-hours worked.

Quarry and crusher employees in the portland-cement industry, material (quarry rock and overburden) handled at quarries included in study, and average output of material per man in the United States, 1938–42

Year	Employment—quarry and crusher only					Material handled—quarry rock and overburden				Percent of industry represented[1]
	Average number of men	Time employed				Short tons	Percent of overburden included	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours				Per shift	Per hour	
				Average per man per day	Total					
1938	4,442	218	968,873	7.6	7,384,387	(2)	(2)	(2)	(2)	90.3
1939 [3]	4,433	234	1,037,183	7.6	7,904,793	31,952,378	3.9	30.81	4.04	85.3
1940 [3]	4,394	244	1,070,881	7.6	8,171,104	33,804,500	2.6	31.57	4.14	82.6
1941 [3]	4,858	269	1,307,370	7.7	10,088,738	44,361,943	4.1	33.93	4.40	91.2
1942 [3]	5,090	280	1,423,290	7.8	11,089,206	50,959,664	10.4	35.80	4.60	90.9

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.
[2] Figures not available.
[3] Exclusive of Puerto Rico.

HOURS PER DAY

In general, the length of the average working day in the cement industry during 1942 was shorter than in 1941. Slightly less than half of the total employees in 1942 worked an average day of 8 to 9 hours, whereas in 1941 nearly two-thirds of the employees worked an average day of the same length.

Number of men employed in the portland-cement industry in the United States[1] and output per man-hour, 1940–42, classified according to hours of labor per day

Hours per day	1940			1941			1942		
	Men employed		Production per man-hour (barrels)	Men employed		Production per man-hour (barrels)	Men employed		Production per man-hour (barrels)
	Number	Percent of total		Number	Percent of total		Number	Percent of total	
Less than 6	681	2.6	2.44				1,395	4.7	2.77
6 and less than 7	6,282	24.1	2.62	5,872	20.7	2.65	6,043	20.3	2.54
7 and less than 8	4,679	18.0	2.20	4,607	16.2	2.39	8,427	28.3	2.75
8 and less than 9	14,263	54.8	2.37	17,809	62.7	2.60	13,672	45.9	2.50
9 and less than 10	133	.5	2.29	121	.4	2.30	231	.8	2.60
	26,038	100.0	2.40	28,409	100.0	2.57	29,768	100.0	2.59

[1] Exclusive of Puerto Rico.

EMPLOYMENT BY DISTRICTS AND STATES

In 1942 the number of employees working at cement plants in the Eastern Pennsylvania-New Jersey-Maryland district and in the State of Pennsylvania exceeded by far the number employed at plants in any other district or State. Although employment in the Eastern Pennsylvania-New Jersey-Maryland district represented 19 percent of the total, output from mills in this district was only 17 percent of total production during 1942. The employment data for 1941 and 1942 are broken down by districts and States in the following tables.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)

District and State	Employment					Production			Per-cent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1941									
DISTRICT									
Eastern Pennsylvania, New Jersey, and Maryland	5,627	319	1,794,121	7.0	12,563,015	31,017,939	17.29	2.47	100.0
New York and Maine	1,942	298	578,433	7.5	4,318,191	11,995,299	20.74	2.78	100.0
Ohio, western Pennsylvania, and West Virginia	3,319	304	1,008,838	7.5	7,608,512	15,153,118	15.02	1.99	100.0
Michigan	1,787	293	523,066	7.9	4,143,411	9,485,147	18.13	2.29	100.0
Wisconsin, Illinois, Indiana, and Kentucky	2,824	317	895,131	6.8	6,100,749	16,224,049	18.12	2.66	100.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	3,446	297	1,021,881	7.4	7,562,109	19,982,460	19.55	2.64	100.0
Eastern Missouri, Iowa, Minnesota, and South Dakota	2,425	281	681,274	7.4	5,022,521	11,856,659	17.40	2.36	100.0
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1,704	292	497,900	7.5	3,738,332	9,903,055	19.89	2.65	100.0
Texas	1,489	291	433,776	7.6	3,307,176	9,679,696	22.31	2.93	100.0
Colorado, Montana, Utah, Wyoming, and Idaho	626	285	178,473	7.7	1,381,968	3,954,582	22.16	2.86	100.0
California	2,412	319	768,667	8.0	6,148,865	19,935,309	25.93	3.24	100.0
Oregon and Washington	808	271	219,012	8.0	1,741,768	4,380,618	20.00	2.52	100.0
	28,409	303	8,600,572	7.4	63,636,617	163,567,931	19.02	2.57	100.0
STATE									
Alabama	1,079	306	320,853	7.3	2,412,552	7,410,499	22.47	3.07	100.0
California	2,412	319	768,667	8.0	6,148,865	19,935,309	25.93	3.24	100.0
Illinois	1,037	320	332,207	6.3	2,109,361	5,854,218	17.62	2.78	100.0
Iowa	1,169	263	308,026	7.7	2,357,167	5,064,620	16.44	2.15	100.0
Kansas	871	268	233,300	7.6	1,776,003	4,680,636	20.06	2.64	100.0
Michigan	1,787	293	523,066	7.9	4,143,411	9,485,147	18.13	2.29	100.0
Missouri	1,203	292	351,370	7.2	2,526,229	6,328,003	18.01	2.50	100.0
New York	1,835	299	547,871	7.4	4,073,694	11,444,508	20.89	2.81	100.0
Ohio	1,663	317	527,317	7.5	3,975,129	8,155,704	15.47	2.05	100.0
Pennsylvania	5,722	312	1,787,613	7.1	12,692,598	32,199,184	18.01	2.54	100.0
Tennessee	950	295	280,618	7.6	2,145,842	5,588,488	19.91	2.60	100.0
Texas	1,489	291	433,776	7.6	3,307,176	9,679,696	22.31	2.93	100.0
Other States [2]	7,192	303	2,176,888	7.3	15,968,590	37,741,919	17.34	2.36	100.0
	28,409	303	8,600,572	7.4	63,636,617	163,567,931	19.02	2.57	100.0

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)—Continued

District and State	Employment					Production			Percent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours					
				Average per man per day	Total		Per shift	Per hour	
1942									
DISTRICT									
Eastern Pennsylvania, New Jersey, and Maryland	5,730	308	1,762,644	7.2	12,742,810	31,520,249	17.88	2.47	100.0
New York and Maine	1,966	299	587,533	7.3	4,277,748	11,707,273	19.93	2.74	100.0
Ohio, western Pennsylvania, and West Virginia	3,207	322	1,033,637	7.6	7,857,846	15,573,618	15.07	1.98	100.0
Michigan	1,907	305	582,025	8.0	4,642,207	10,615,927	18.24	2.29	100.0
Wisconsin, Illinois, Indiana, and Kentucky	2,938	326	957,733	7.0	6,710,119	18,618,434	19.44	2.77	100.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	3,572	315	1,124,505	7.5	8,487,750	21,808,052	19.39	2.57	100.0
Eastern Missouri, Iowa, Minnesota, and South Dakota	2,663	294	782,738	7.3	5,751,452	12,833,837	16.40	2.23	100.0
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	2,053	312	640,574	7.5	4,832,779	13,718,391	21.42	2.84	100.0
Texas	1,572	342	538,143	7.4	4,005,751	12,132,707	22.55	3.03	100.0
Colorado, Montana, Utah, Wyoming, and Idaho	696	327	227,500	8.1	1,833,303	4,371,442	19.22	2.38	100.0
California	2,585	340	879,124	8.0	7,064,817	23,350,674	26.56	3.31	100.0
Oregon and Washington	879	294	258,695	7.7	1,997,105	5,863,882	22.67	2.94	100.0
	29,768	315	9,374,851	7.5	70,203,687	182,114,486	19.43	2.59	100.0
STATE									
Alabama	1,220	327	398,937	7.5	3,008,057	8,534,324	21.39	2.84	100.0
California	2,585	340	879,124	8.0	7,064,817	23,350,674	26.56	3.31	100.0
Illinois	1,112	342	380,782	6.3	2,384,776	7,049,636	18.51	2.96	100.0
Iowa	1,188	271	322,128	7.6	2,448,538	5,062,230	15.71	2.07	100.0
Kansas	1,099	311	341,400	7.5	2,574,042	7,254,906	21.25	2.82	100.0
Michigan	1,907	305	582,025	8.0	4,642,207	10,615,927	18.24	2.29	100.0
Missouri	1,397	295	411,689	7.3	2,987,052	6,971,938	16.93	2.33	100.0
New York	1,832	300	550,414	7.2	3,980,800	11,067,269	20.11	2.78	100.0
Ohio	1,685	325	548,118	7.9	4,313,891	8,181,615	14.93	1.90	100.0
Pennsylvania	5,700	323	1,842,853	7.4	13,561,139	34,114,074	18.51	2.52	100.0
Tennessee	1,019	324	329,971	7.6	2,499,620	6,402,291	19.40	2.56	100.0
Texas	1,572	342	538,143	7.4	4,005,751	12,132,707	22.55	3.03	100.0
Other States [2]	7,452	302	2,249,267	7.4	16,732,997	41,376,895	18.40	2.47	100.0
	29,768	315	9,374,851	7.5	70,203,687	182,114,486	19.43	2.59	100.0

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)

District and State	Employment—cement mill only					Production			Percent of industry represented[1]
		Time employed					Average per man (barrels)		
				Man-hours					
	Average number of men	Average number of days	Total man-shifts	Average per man per day	Total	Finished portland cement (barrels)	Per shift	Per hour	
1941									
DISTRICT									
Eastern Pennsylvania, New Jersey, and Maryland	4,544	325	1,478,979	6.8	10,115,691	31,017,939	20.97	3.07	100.0
New York and Maine	1,564	310	485,107	7.4	3,592,423	11,995,299	24.73	3.34	100.0
Ohio, western Pennsylvania, and West Virginia	2,302	313	719,559	7.5	5,416,588	15,153,118	21.06	2.80	100.0
Michigan	1,523	299	455,088	8.0	3,629,724	9,485,147	20.84	2.61	100.0
Wisconsin, Illinois, Indiana, and Kentucky	2,413	326	785,657	6.8	5,331,257	16,224,049	20.65	3.04	100.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	2,607	302	788,425	7.3	5,759,824	19,982,460	25.34	3.47	100.0
Eastern Missouri, Iowa, Minnesota, and South Dakota	1,944	291	566,470	7.3	4,153,157	11,856,659	20.93	2.85	100.0
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1,262	295	372,760	7.4	2,766,612	9,903,055	26.57	3.58	100.0
Texas	1,082	296	320,636	7.6	2,432,244	9,679,696	30.19	3.98	100.0
Colorado, Montana, Utah, Wyoming, and Idaho	467	289	135,111	7.7	1,046,835	3,954,582	29.27	3.78	100.0
California	1,887	330	623,031	8.0	4,985,052	19,935,309	32.00	4.00	100.0
Oregon and Washington	610	285	174,082	8.0	1,387,453	4,380,618	25.16	3.16	100.0
	22,205	311	6,904,905	7.3	50,616,860	163,567,931	23.69	3.23	100.0
STATE									
Alabama	849	316	268,192	7.2	1,945,679	7,410,499	27.63	3.81	100.0
California	1,887	330	623,031	8.0	4,985,052	19,935,309	32.00	4.00	100.0
Illinois	817	333	272,173	6.3	1,726,676	5,854,218	21.51	3.39	100.0
Iowa	916	273	250,023	7.6	1,907,474	5,064,620	20.26	2.66	100.0
Kansas	644	266	171,321	7.5	1,288,755	4,680,636	27.32	3.63	100.0
Michigan	1,523	299	455,088	8.0	3,629,724	9,485,147	20.84	2.61	100.0
Missouri	960	301	288,547	7.1	2,046,767	6,328,003	21.93	3.09	100.0
New York	1,474	311	458,183	7.4	3,377,030	11,444,508	24.98	3.39	100.0
Ohio	1,320	329	433,668	7.5	3,247,478	8,155,704	18.81	2.51	100.0
Pennsylvania	4,588	319	1,464,431	7.0	10,180,413	32,199,184	21.99	3.16	100.0
Tennessee	700	299	209,437	7.5	1,567,393	5,588,488	26.68	3.57	100.0
Texas	1,082	296	320,636	7.6	2,432,244	9,679,696	30.19	3.98	100.0
Other States[2]	5,445	310	1,690,175	7.3	12,282,175	37,741,919	22.33	3.07	100.0
	22,205	311	6,904,905	7.3	50,616,860	163,567,931	23.69	3.23	100.0

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)—Continued

District and State	Employment—cement mill only					Production			Per cent of industry represented[1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1942									
DISTRICT									
Eastern Pennsylvania, New Jersey, and Maryland	4,612	315	1,453,502	7.1	10,330,728	31,520,249	21.69	3.05	100.0
New York and Maine	1,644	309	507,908	7.2	3,637,762	11,707,273	23.05	3.22	100.0
Ohio, western Pennsylvania, and West Virginia	2,233	336	751,277	7.7	5,759,417	15,573,618	20.73	2.70	100.0
Michigan	1,394	322	448,447	8.0	3,586,922	10,615,927	23.67	2.96	100.0
Wisconsin, Illinois, Indiana, and Kentucky	2,626	331	868,754	7.0	6,057,431	18,618,434	21.43	3.07	100.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	2,693	322	867,682	7.4	6,440,491	21,808,052	25.18	3.39	100.0
Eastern Missouri, Iowa, Minnesota, and South Dakota	2,219	302	669,335	7.3	4,890,645	12,833,837	19.17	2.62	100.0
Western Missouri, Nebraska, Kansas, Oklahoma and Arkansas	1,546	318	490,872	7.4	3,648,098	13,718,391	27.95	3.76	100.0
Texas	1,194	348	415,547	7.5	3,100,632	12,132,707	29.20	3.91	100.0
Colorado, Montana, Utah, Wyoming, and Idaho	555	337	187,031	8.1	1,515,071	4,371,442	23.37	2.89	100.0
California	2,091	345	720,885	8.0	5,786,697	23,350,674	32.39	4.04	100.0
Oregon and Washington	685	304	208,199	7.6	1,591,266	5,863,882	28.16	3.69	100.0
	23,492	323	7,589,439	7.4	56,345,160	182,114,486	24.00	3.23	100.0
STATE									
Alabama	951	336	319,205	7.5	2,380,302	8,534,324	26.74	3.59	100.0
California	2,091	345	720,885	8.0	5,786,697	23,350,674	32.39	4.04	100.0
Illinois	964	349	336,236	6.2	2,096,459	7,049,636	20.97	3.36	100.0
Iowa	996	278	276,444	7.5	2,082,693	5,062,230	18.31	2.43	100.0
Kansas	800	315	251,839	7.4	1,860,096	7,254,906	28.81	3.90	100.0
Michigan	1,394	322	448,447	8.0	3,586,922	10,615,927	23.67	2.96	100.0
Missouri	1,089	303	330,300	7.2	2,379,204	6,971,938	21.11	2.93	100.0
New York	1,528	311	475,712	7.7	3,380,195	11,067,269	23.26	3.27	100.0
Ohio	1,322	338	447,047	7.9	3,524,078	8,181,615	18.30	2.32	100.0
Pennsylvania	4,534	333	1,507,894	7.3	10,933,243	34,114,074	22.62	3.12	100.0
Tennessee	744	332	246,800	7.4	1,816,660	6,402,291	25.94	3.52	100.0
Texas	1,194	348	415,547	7.5	3,100,632	12,132,707	29.20	3.91	100.0
Other States[2]	5,885	308	1,813,083	7.4	13,417,979	41,376,895	22.82	3.08	100.0
	23,492	323	7,589,439	7.4	56,345,160	182,114,486	24.00	3.23	100.0

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Quarry and crusher employees in the portland-cement industry, material (quarry rock and overburden) handled at quarries included in study, and average output of material per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)

District and State	Employment—quarry and crusher only					Material handled—quarry rock and overburden				Percent of industry represented[1]
	Average number of men	Time employed				Short tons	Percent of overburden included	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours						
				Average per man per day	Total			Per shift	Per hour	
1941										
DISTRICT										
Eastern Pennsylvania, New Jersey, and Maryland	907	283	256,930	7.9	2,028,481	8,472,159	1.4	32.97	4.18	96.0
New York and Maine	274	257	70,295	7.9	556,528	3,047,618	2.6	43.35	5.48	100.0
Ohio, western Pennsylvania, and West Virginia	813	278	226,183	7.6	1,714,050	4,722,126	8.1	20.88	2.75	72.6
Michigan	190	240	45,573	7.3	334,446	1,136,431	9.2	24.94	3.40	64.3
Wisconsin, Illinois, Indiana, and Kentucky	331	264	87,474	7.3	637,492	3,014,676	5.7	34.46	4.73	76.0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	759	277	210,006	7.7	1,622,369	6,011,876	2.1	28.63	3.71	100.0
Eastern Missouri, Iowa, Minnesota, and South Dakota	376	232	87,103	7.7	667,810	3,957,614	10.6	45.44	5.93	92.4
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	346	267	92,323	7.9	725,148	2,549,950	3.5	27.62	3.52	100.0
Texas	170	276	46,910	7.3	343,809	2,263,624	-------	48.25	6.58	96.3
Colorado, Montana, Utah, Wyoming, and Idaho	103	263	27,077	7.6	207,043	1,198,778	1.1	44.27	5.79	100.0
California	392	288	112,751	8.0	898,730	6,573,887	4.0	58.30	7.31	98.0
Oregon and Washington	197	227	44,745	7.9	352,832	1,413,204	3.7	31.58	4.01	100.0
	4,858	269	1,307,370	7.7	10,088,738	44,361,943	4.1	33.93	4.40	91.2
STATE										
Alabama	228	269	61,259	7.6	463,655	2,325,649	(2)	37.96	5.02	100.0
California	392	288	112,751	8.0	898,730	6,573,887	4.0	58.30	7.31	98.0
Illinois	140	272	38,034	6.6	250,685	1,712,158	3.3	45.02	6.83	100.0
Iowa	170	215	36,506	7.9	288,465	1,666,797	1.8	45.66	5.78	100.0
Kansas	158	245	38,766	8.1	314,749	1,173,718	7.6	30.28	3.73	100.0
Michigan	190	240	45,573	7.3	334,446	1,136,431	9.2	24.94	3.40	64.3
Missouri	243	259	62,823	7.6	479,462	2,490,851	15.6	39.65	5.20	100.0
New York	257	259	66,657	7.9	527,424	2,903,828	2.8	43.56	5.51	100.0
Ohio	289	268	77,326	7.7	597,067	2,332,197	9.0	30.16	3.91	84.2
Pennsylvania	962	278	267,573	7.9	2,113,396	8,416,273	3.1	31.45	3.98	87.0
Tennessee	222	287	63,605	8.1	517,844	1,323,134	(2)	20.80	2.56	100.0
Texas	170	276	46,910	7.3	343,809	2,263,624	-------	48.25	6.58	96.4
Other States[3]	1,437	271	389,587	7.7	2,959,006	10,043,396	3.0	25.78	3.36	87.3
	4,858	269	1,307,370	7.7	10,088,738	44,361,943	4.1	33.93	4.40	91.2

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Less than 0.1 percent.

[3] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Quarry and crusher employees in the portland-cement industry, material (quarry rock and overburden) handled at quarries included in study, and average output of material per man in the United States, 1941–42, by districts and by States (excluding Puerto Rico)—Continued

District and State	Employment—quarry and crusher only: Average number of men	Employment—quarry and crusher only: Time employed: Average number of days	Employment—quarry and crusher only: Time employed: Total man-shifts	Employment—quarry and crusher only: Time employed: Man-hours: Average per man per day	Employment—quarry and crusher only: Time employed: Man-hours: Total	Material handled—quarry rock and overburden: Short tons	Material handled—quarry rock and overburden: Percent of overburden included	Material handled—quarry rock and overburden: Average per man (short tons): Per shift	Material handled—quarry rock and overburden: Average per man (short tons): Per hour	Percent of industry represented [1]
1942										
DISTRICT										
Eastern Pennsylvania, New Jersey, and Maryland	974	269	262, 290	7. 8	2, 049, 829	9, 128, 841	2. 3	34. 80	4. 45	95. 3
New York and Maine	286	244	69, 641	8. 1	564, 176	3, 280, 347	11. 8	47. 10	5. 81	100. 0
Ohio, western Pennsylvania, and West Virginia	765	285	218, 250	7. 5	1, 643, 247	5, 400, 183	21. 3	24. 74	3. 29	73. 7
Michigan	169	234	39, 551	7. 7	303, 181	971, 204	1. 3	24. 56	3. 20	67. 9
Wisconsin, Illinois, Indiana, and Kentucky	312	285	88, 979	7. 3	652, 688	2, 482, 406	6. 8	27. 90	3. 80	72. 4
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	826	294	242, 740	8. 0	1, 943, 402	6, 802, 058	5. 9	28. 02	3. 50	100. 0
Eastern Missouri, Iowa, Minnesota, and South Dakota	435	254	110, 676	7. 6	838, 991	5. 622, 673	27. 9	50. 80	6. 70	91. 5
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	420	289	121, 481	7. 9	958, 989	3, 196, 166	7. 4	26. 31	3. 33	100. 0
Texas	166	309	51, 220	7. 4	378, 954	2, 614, 459	. 9	51. 04	6. 90	94. 2
Colorado, Montana, Utah, Wyoming, and Idaho	108	277	29, 959	7. 8	234, 479	1, 161, 994	1. 3	38. 79	4. 96	100. 0
California	437	317	138, 460	8. 1	1, 119, 054	8, 672, 342	12. 2	62. 63	7. 75	97. 3
Oregon and Washington	192	261	50, 043	8. 0	402, 216	1, 626, 991	4. 8	32. 51	4. 05	100. 0
	5, 090	280	1, 423, 290	7. 8	11, 089, 206	50, 959, 664	10. 4	35. 80	4. 60	90. 9
STATE										
Alabama	255	305	77, 735	7. 9	611, 779	2, 455, 574	([2])	31. 59	4. 01	100. 0
California	437	317	138, 460	8. 1	1, 119, 054	8, 672, 342	12. 2	62. 63	7. 75	97. 3
Illinois	148	301	44, 546	6. 5	288, 317	2, 010, 352	4. 1	45. 13	6. 97	100. 0
Iowa	183	235	42, 957	8. 0	344, 029	1, 707, 757	3. 6	39. 76	4. 96	100. 0
Kansas	215	290	62, 408	8. 0	497, 748	1, 789, 174	13. 3	28. 67	3. 59	100. 0
Michigan	169	234	39, 551	7. 7	303, 181	971, 204	1. 3	24. 56	3. 20	67. 9
Missouri	308	264	81, 389	7. 5	607, 848	4, 097, 188	36. 8	50. 34	6. 74	100. 0
New York	268	241	64, 718	8. 1	524, 795	3, 089, 007	12. 5	47. 73	5. 89	100. 0
Ohio	314	275	86, 497	7. 8	673, 221	2, 214, 553	7. 7	25. 60	3. 29	87. 6
Pennsylvania	1, 000	284	283, 641	7. 9	2, 229, 680	10, 415, 453	11. 4	36. 72	4. 67	86. 7
Tennessee	275	302	83, 171	8. 2	682, 960	1, 886, 180	8. 6	22. 68	2. 76	100. 0
Texas	166	309	51, 220	7. 4	378, 954	2, 614, 459	. 9	51. 04	6. 90	94. 2
Other States [3]	1, 352	271	366, 997	7. 7	2, 827, 640	9, 036, 421	4. 6	24. 62	3. 20	84. 9
	5, 090	280	1, 423, 290	7. 8	11, 089, 206	50, 959, 664	10. 4	35. 80	4. 60	90. 9

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[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production in continental United States.

[2] Less than 0.1 percent.

[3] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

FOREIGN TRADE[10]

Imports.—Following the outbreak of war in Europe in 1939, imports of all hydraulic cements declined rapidly to the negligible quantity of 644 barrels in 1942:

Hydraulic cement imported for consumption in the United States, 1938–43

Year	Barrels	Value	Year	Barrels	Value
1938	1,727,411	$1,436,730	1941	43,466	$59,048
1939	1,913,853	1,860,543	1942	644	2,020
1940	538,060	506,191	1943	(1)	(1)

[1] Data not available for publication.

Imports of all hydraulic cements except "white, nonstaining portland cement" in 1941 and 1942, so far as may be published, are listed by country of origin in the following table. Imports of white, nonstaining cement totaled 1,061 barrels valued at $3,784 in 1941 and 304 barrels, $1,201 in 1942.

Roman, portland, and other hydraulic cements imported for consumption in the United States, 1941–42, by countries[1]

[1943 data not available for publication]

Country	1941		1942	
	Barrels	Value	Barrels	Value
Canada	469	$871	281	$695
Japan	14,367	16,078		
Mexico			59	124
United Kingdom[2]	27,569	38,315		
	42,405	55,264	340	819

[1] Excludes "white, nonstaining, and other special cements."
[2] United Kingdom of Great Britain and Northern Ireland.

Exports.—Exports of cement to foreign countries were sharply higher in 1941 than in 1940, but in 1942 the quantity exported declined 57 percent from 1941. In 1942 exports to Latin American countries, the principal export markets for United States cement, fell appreciably. Despite rising consumption in the Latin American countries, exports of United States cement to these markets in the post-war period probably will be below pre-war levels owing to the rapidly increasing self-sufficiency of these countries. However, this loss may be more than offset by the possibility of increased exports to Far Eastern and European markets when peace returns.

Hydraulic cement exported from the United States, 1939–41

[1943 data not available for publication]

Year	Barrels	Value	Percent of total shipments from mills
1939	1,146,339	$2,352,693	0.9
1940	1,667,595	3,294,118	1.3
1941	2,556,234	5,663,037	1.5
1942	1,100,826	2,707,217	.6

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[10] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Hydraulic cement exported from the United States, 1941–42, by countries

[1943 data not available for publication]

Country	1941		1942	
	Barrels	Value	Barrels	Value
North America:				
Bermuda	9,857	$23,715	(1)	(1)
Canada	17,296	70,279	41,162	$139,108
Central America:				
British Honduras	1,690	3,319	(1)	(1)
Costa Rica	112,706	229,249	106,992	241,245
El Salvador	61,652	112,246	11,472	24,971
Guatemala	4,708	17,429	177	892
Honduras	42,057	79,855	12,337	27,418
Nicaragua	47,598	87,409	22,099	45,723
Panama:				
Canal Zone	916,770	1,712,996	(1)	(1)
Republic of	146,126	285,136	59,281	128,445
Mexico	60,523	147,715	81,098	192,321
Newfoundland and Labrador	363	1,056	(1)	(1)
West Indies:				
British:				
Jamaica	361	1,433	(1)	(1)
Trinidad and Tobago	4,202	10,032	(1)	(1)
Other British	5,153	13,474	(1)	(1)
Cuba	26,809	129,587	19,793	106,488
Curacao (N. W. I.)	105,014	226,473	(1)	(1)
Dominican Republic	102,591	218,664	48,081	108,355
French	62,763	124,732	(1)	(1)
Haiti	45,066	91,225	18,543	41,637
Other North America	839	1,829	(1)	(1)
	1,774,134	3,587,853	(1)	(1)
South America:				
Argentina	23,922	112,711	3,130	13,670
Bolivia	17,220	37,592	595	765
Brazil	65,426	270,791	35,188	96,770
Chile	123,222	260,323	56,772	133,673
Colombia	22,264	83,947	9,488	20,807
Ecuador	29,929	63,738	5,599	13,525
Paraguay	239	1,127	----------	----------
Peru	14,603	44,886	2,223	12,205
Surinam	17,851	37,518	(1)	(1)
Uruguay	14,927	57,139	753	4,126
Venezuela	383,331	922,596	109,666	265,404
Other South America	1,914	4,219	(1)	(1)
	714,848	1,896,587	(1)	(1)
Europe	1,000	3,913	(1)	(1)
Asia:				
Arabia Peninsular States	250	998	(1)	(1)
British Malaya	35,978	66,560	(1)	(1)
India and Dependencies	945	7,179	(1)	(1)
Iran	28	258	(1)	(1)
Netherlands Indies	5,176	21,689	(1)	(1)
Philippine Islands	3,268	21,326	(1)	(1)
Other Asia	340	1,904	(1)	(1)
	45,985	119,914	(1)	(1)
Africa:				
Liberia	15,565	32,927	(1)	(1)
Union of South Africa	1,587	11,797	(1)	(1)
Other Africa	2,457	8,047	(1)	(1)
	19,609	52,771	(1)	(1)
Oceania	658	1,999	(1)	(1)
	2,556,234	5,663,037	1,100,826	2,707,217

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[1] Data not available for publication.

Shipments of hydraulic cement to noncontiguous Territories of the United States in 1941 were: 254,457 barrels valued at $554,363 to Alaska, 1,074,230 barrels at $1,887,383 to Hawaii, 800,860 barrels at $1,584,195 to Puerto Rico, and 52,369 barrels at $108,547 to the Virgin Islands.

WORLD PRODUCTION

World production of hydraulic cements in 1943 is estimated at 81,000,000 metric tons, a gain of 13 percent over the estimated output in 1942.

Although production in 1943 declined in the United States and Canada, outputs in nearly all other countries of the American continents were appreciably higher than in 1942 owing to greatly increased activity in road, housing, industrial, and public-works construction. The Latin American countries are prospering during the war and the governments of many of them already have embarked on ambitious public-works and housing programs. However, in some of these countries, notably in Brazil, inadequate fuel supplies limited production in 1943.

The changing tide of war in Europe probably resulted in increased output of cement in 1943 as the Allies built new airfields and roads and repaired damage in regained territories, and as the Axis countries rushed fortifications and other military construction. Shortage of transportation facilities and fuel supplies appeared to be the factors determining the rate of operations at most European plants. In general, plants in sections remote from the war fronts, as in eastern Germany, or distant from fuel supplies, as in Denmark, reportedly were operated at relatively low rates. Plants in more favorable locations apparently were operated at or near capacity.

In Asia and Australia production probably advanced over 1942 as the Allies became the attackers, and the Japanese rushed military and other construction to entrench themselves in the conquered areas. Production probably declined in South Africa and increased in the countries of northern Africa.

World production of hydraulic cements, 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer and Forrest T. Moyer]

Country	1938	1939	1940	1941	1942	1943
North America:						
Canada	876,193	909,875	1,200,143	1,328,587	1,448,183	1,158,797
Cuba	(2)	(2)	(2)	(2)	165,189	169,609
Guatemala	(2)	(2)	(2)	(2)	(2)	(2)
Mexico	373,712	409,784	484,992	537,464	584,000	744,000
Nicaragua	----	----	----	----	620	10,627
United States	18,279,156	21,267,269	22,640,675	28,465,880	31,609,981	23,067,914
South America:						
Argentina	1,245,458	1,141,865	1,088,591	1,168,881	1,076,858	(2)
Bolivia	18,600	(2)	24,285	(2)	(2)	(2)
Brazil	617,896	697,793	743,634	767,506	752,839	747,409
Chile	363,987	340,758	385,091	359,720	451,640	(2)
Colombia	141,809	167,000	188,000	210,912	207,793	[3] 225,000
Ecuador	(2)	14,249	16,481	17,014	19,802	(2)
Peru	101,380	119,986	124,480	167,872	188,882	208,599
Uruguay	158,359	164,434	137,880	151,913	(2)	(2)
Venezuela	39,863	39,130	87,068	[3] 117,000	[3] 117,000	[3] 120,000
Europe:						
Albania	(2)	(2)	(2)	(2)	(2)	(2)
Belgium	3,054,144	2,551,756	(2)	(2)	(2)	(2)
Bulgaria	180,000	(2)	(2)	(2)	(2)	(2)
Czechoslovakia	(2)	(2)	(2)	(2)	(2)	(2)
Denmark	639,957	696,000	441,000	(2)	(2)	(2)
Estonia	79,740	77,000	(2)	(2)	(2)	(2)
Finland	475,152	563,000	(2)	(2)	(2)	(2)
France	(2)	(2)	(2)	(2)	(2)	(2)
Germany	15,600,000	(2)	(2)	(2)	(2)	(2)
Austria	650,000	(2)	(2)	(2)	(2)	(2)
Greece	308,000	(2)	(2)	(2)	(2)	(2)
Hungary	395,000	(2)	(2)	(2)	(2)	(2)
Ireland	110,000	261,000	272,000	(2)	(2)	(2)
Italy	4,607,454	4.800,000	(2)	(2)	(2)	(2)
Latvia	154,621	164,601	(2)	(2)	(2)	(2)
Netherlands	456,000	541,000	(2)	(2)	(2)	(2)
Norway	331,600	390,000	(2)	(2)	(2)	(2)
Poland	1,719,452	(2)	(2)	(2)	(2)	(2)
Portugal	268,000	297,000	271,173	(2)	[4] 186,967	(2)
Rumania	448,402	531,000	400,000	(2)	(2)	(2)
Spain	592,427	1,194,481	1,557,878	1,361,233	1,375,713	[3] 1,600,000
Sweden	992,932	1,184,991	700,749	645,338	(2)	(2)
Switzerland	[5] 650,000	(2)	650,000	[3] 700,000	[3] 500,000	(2)
U. S. S. R	5,696,000	5,700,000	5,800.000	(2)	(2)	(2)
United Kingdom	7,900,000	(2)	(2)	(2)	(2)	(2)
Yugoslavia	712,302	663,000	(2)	(2)	(2)	(2)
Asia:						
China	24,000	[5] 540,000	652,500	(2)	(2)	(2)
Manchuria	(2)	(2)	(2)	(2)	(2)	(2)
Chosen	(2)	(2)	(2)	(2)	(2)	(2)
Hong Kong	110,036	(2)	(2)	(2)	(2)	(2)
India, British	(2)	(2)	(2)	(2)	(2)	(2)
Indochina	266,366	305,800	278,500	(2)	(2)	(2)
Iran	(2)	(2)	(2)	(2)	(2)	(2)
Japan and colonies	5,519,000	5,074,000	[3] 4,250,000	(2)	(2)	(2)
Netherlands Indies	(2)	[3] 170,000	(2)	(2)	(2)	(2)
Palestine	98,445	112,350	148,487	(2)	(2)	(2)
Philippine Islands	167,448	(2)	(2)	(2)	(2)	(2)
Syria and Lebanon	251,000	227,285	91,653	(2)	250,000	[3] 200,000
Thailand (Siam)	82,000	[6] 92,000	[6] 116,864	(2)	(2)	(2)
Turkey	267,568	283,624	266,637	276,509	192,750	(2)
Africa:						
Algeria	(2)	(2)	(2)	(2)	(2)	(2)
Belgian Congo	16,500	35,000	(2)	(2)	(2)	(2)
Egypt	375,763	371,941	360,832	420,107	420,980	322,859
Morocco, French	165,000	(2)	(2)	(2)	(2)	(2)
Mozambique	24,297	27,618	27,893	(2)	(2)	(2)
Tunisia	68,700	(2)	(2)	(2)	(2)	(2)
Union of South Africa	878,206	948,664	831,018	(2)	(2)	(2)
Oceania:						
Australia [7]	862,539	881,778	879,000	(2)	(2)	(2)
New Zealand [6]	220,000	235,000	(2)	(2)	(2)	(2)
	[3] 85,859,000	[3] 93,000,000	[3] 81,000,000	[3] 77,000,000	[3] 72,000,000	[3] 81,000,000

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[1] Data cover all hydraulic cements.
[2] Data not available; estimate included in total.
[3] Estimate.
[4] January to September, inclusive.
[5] Shipments.
[6] Year ended Mar. 31 of year stated.
[7] Year ended June 30 of year stated.

STONE

By Oliver Bowles and M. S. Jensen

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GENERAL CONDITIONS

Sales of crushed and dimension stone combined (171,343,250 tons) were 13 percent less in 1943 than in 1942 when output attained an all-time high record of 195,884,490 short tons. The total value of sales ($184,320,034) was 10 percent smaller than in 1942. Sales of crushed and broken stone declined because the peak of Government construction had been passed and privately financed construction was very small. Dimension stone sales declined still further from the unusually low levels of 1942 because wartime construction requires very small quantities of building stone. Crushed and broken stone output declined 12 percent in quantity and 9 percent in value, and dimension stone (excluding slate) 38 percent in quantity and 20 percent in value.

The present chapter follows the general plan inaugurated in 1938, whereby the data on dimension stone are separated from those on crushed stone, except in the introductory general tables.

The tables of this report give the quantities sold or used by producers and the values f. o. b. quarries and mills insofar as these figures are obtainable. Stone quarried and used by producers is considered as sold and is included in the statistics of sales. The data, however, do not include stone made into abrasives (such as grindstones) or that used in making lime and cement. These materials are reported in terms of finished products in the Abrasive Materials, Lime, and Cement chapters of this volume. The following tables show the total sales of stone by kinds, uses, and States.

Stone sold or used by producers in the United States, 1939-43, by kinds

[Quantities approximate]

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	12, 041, 360	$22, 495, 983	16, 091, 250	$14, 164, 016	228, 080	$6, 688, 662	100, 846, 090	$94, 817, 481
1940	10, 880, 580	21, 621, 943	15, 715, 890	15, 185, 652	239, 730	5, 196, 124	112, 658, 060	103, 007, 305
1941	14, 298, 750	24, 968, 489	17, 936. 950	18, 641, 852	176, 460	4, 785, 710	133, 163, 600	127, 585, 118
1942	14, 064, 780	23, 794, 514	17, 626, 660	21, 005. 943	169, 500	3, 910, 203	142, 487, 600	138, 578, 027
1943	9, 240, 280	18, 217, 064	14, 385, 260	17, 699, 907	168, 790	3, 610, 035	128, 980, 270	127, 296, 872

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	8, 853, 680	$11, 745, 631	9, 386, 670	$8, 549, 742	147, 447, 130	$158, 461, 515
1940	6, 498, 960	8, 513, 654	7, 739. 820	6, 519, 437	153, 733, 040	160, 044, 115
1941	7, 592, 820	10, 768, 748	9, 939. 380	8, 587, 509	183, 107, 960	195, 337. 426
1942	6, 700, 920	8, 620, 453	14, 835, 030	9, 092, 879	195, 884, 490	205, 002, 019
1943	7, 408, 230	11, 071, 258	11, 160. 420	6, 424, 898	171, 343, 250	184, 320, 034

[1] Includes mica schist, conglomerate, argillite, various light-color volcanic rocks, serpentine not used as marble, soapstone sold as dimension stone, and such other stone as cannot properly be classed in any main group.

Stone sold or used by producers in the United States, 1942-43, by uses

Use	1942		1943	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction ....short tons..	267, 100	$1, 354, 087	228, 410	$961, 416
Cut stone, slabs, and mill blocks..cubic feet.	2, 848, 180	4, 572, 074	1, 182, 930	1, 845, 230
Approximate equivalent in short tons....	214, 100	....	90, 210	....
Rubble.........................short tons..	544, 450	957, 790	252, 770	402, 900
Monumental stone...............cubic feet..	2, 737, 240	8, 976, 566	2, 541. 080	9, 731, 521
Approximate equivalent in short tons......	225, 910	....	209, 840	....
Paving blocks........................number..	1, 986, 910	188, 830	651, 890	67, 333
Approximate equivalent in short tons......	18, 540	....	7, 030	....
Curbing..........................cubic feet..	314, 830	361, 590	147, 760	172, 223
Approximate equivalent in short tons......	25, 380	....	11, 640	....
Flagging.........................cubic feet..	679, 990	290, 646	415, 850	186, 732
Approximate equivalent in short tons......	51, 980	....	31, 820	....
Total dimension stone (quantities approximate, in short tons)...............	1, 347, 460	16, 701, 583	831, 720	13, 367, 355
Crushed and broken stone:				
Riprap.........................short tons..	8, 763, 980	9, 779, 249	4, 950, 470	4, 834, 513
Crushed stone.........................do....	125, 267, 650	116, 394, 778	99, 648, 080	94, 744, 029
Furnace flux (limestone and marble)..do....	30, 262, 910	24, 152, 113	[1] 31, 570, 650	[1] 24, 505, 567
Refractory stone [2]........................do....	2, 718, 090	3, 999, 929	2, 707, 860	4, 577, 047
Agricultural (limestone)...............do....	13, 745, 400	16, 993, 254	14, 521, 670	19, 057, 120
Other uses.............................do....	13, 779, 000	16, 981, 113	17, 112, 800	23, 234, 403
Total crushed and broken stone....do....	194, 537, 030	188, 300, 436	170, 511, 530	170, 952, 679
Grand total (quantities approximate, in short tons)............................	195, 884, 490	205, 002, 019	171, 343, 250	184, 320, 034

[1] Limestone only.
[2] Ganister (sandstone), mica schist, soapstone, and dolomite.

Stone sold or used by noncommercial producers in the United States, 1942–43, by uses

[Included in total production]

Use	1942		1943	
	Short tons	Value	Short tons	Value
Building stone	148, 650	$309, 562	32, 560	$45, 412
Rubble	95, 940	241, 359	24, 710	20, 590
Curbing	1, 470	9, 157	----------	----------
Riprap	2, 787, 210	2, 667, 495	1, 302, 900	928, 406
Crushed stone	15, 449, 080	16, 262, 654	7, 505, 770	7, 857, 022
Agricultural (limestone)	428, 180	375, 259	334, 680	365, 245
Other uses	491, 700	400, 846	839, 310	874, 925
	19, 402, 230	20, 266, 332	10, 039, 930	10, 091, 600

Stone sold or used by producers in the United States, 1942–43, by States

State	1942		1943	
	Short tons (approximate)	Value	Short tons (approximate)	Value
Alabama	3, 141, 800	$3, 738, 902	2, 568, 520	$3, 178, 908
Alaska	----------	----------	(1)	(1)
Arizona	227, 220	219, 231	340, 200	317, 454
Arkansas	2, 033, 410	2, 152, 956	1, 492, 410	1, 568, 883
California	[2] 12, 288, 700	[2] 11, 031, 326	8, 231, 250	6, 595, 799
Colorado	[2] 951, 510	[2] 735, 994	880, 430	662, 804
Connecticut	1, 556, 350	1, 692, 399	1, 184, 950	1, 392, 215
Delaware	(1)	(1)	(1)	(1)
Florida	[2] 6, 632, 680	[2] 5, 733, 697	[2] 8, 741, 200	[2] 7, 446, 388
Georgia	[2] 3, 623, 160	[2] 6, 620, 633	2, 178, 510	5, 373, 879
Hawaii	(1)	(1)	(1)	(1)
Idaho	470, 590	588, 989	91, 330	127, 092
Illinois	14, 056, 050	12, 686, 759	11, 137, 960	10, 762, 707
Indiana	[2] 6, 460, 540	[2] 7, 007, 241	5, 381, 940	5, 570, 790
Iowa	4, 474, 480	4, 849, 803	3, 544, 560	4, 327, 782
Kansas	2, 588, 200	3, 031, 049	2, 074, 580	2, 291, 198
Kentucky	[2] 5, 641, 280	[2] 5, 454, 914	4, 621, 720	4, 309, 201
Louisiana	(1)	(1)	(1)	(1)
Maine	[2] 196, 010	[2] 556, 655	201, 450	409, 780
Maryland	1, 220, 190	1, 807, 265	1, 423, 970	2, 029, 927
Massachusetts	[2] 1, 800, 600	[2] 3, 468, 788	[2] 1, 370, 460	[2] 2, 170, 408
Michigan	16, 093, 050	9, 433, 035	15, 919, 780	9, 669, 672
Minnesota	[2] 1, 451, 210	[2] 1, 858, 631	[2] 658, 600	[2] 1, 205, 910
Mississippi	----------	----------	(1)	(1)
Missouri	[2] 9, 235, 540	[2] 8, 347, 132	5, 636, 040	5, 864, 095
Montana	393, 200	303, 250	509, 540	365, 777
Nebraska	267, 020	630, 413	538, 380	968, 982
Nevada	137, 920	196, 726	107, 390	165, 483
New Hampshire	237, 090	440, 714	70, 910	171, 371
New Jersey	3, 393, 510	3, 776, 745	2, 611, 440	3, 584, 645
New Mexico	515, 240	248, 895	[2] 421, 590	[2] 228, 432
New York	11, 244, 670	11, 513, 020	8, 660, 970	8, 917, 164
North Carolina	3, 039, 580	3, 774, 472	4, 871, 260	5, 376, 600
North Dakota	(1)	(1)	----------	----------
Ohio	14, 831, 660	13, 546, 490	15, 909, 740	15, 598, 542
Oklahoma	5, 946, 520	3, 172, 547	6, 169, 750	3, 205, 329
Oregon	2, 596, 030	2, 635, 086	1, 535, 490	1, 834, 271
Pennsylvania	[2] 23, 131, 670	[2] 26, 892, 960	[2] 19, 999, 570	[2] 23, 566, 298
Puerto Rico	(1)	(1)	(1)	(1)
Rhode Island	191, 420	351, 664	171, 230	410, 478
South Carolina	2, 040, 610	2, 624, 284	[2] 1, 615, 730	[2] 1, 804, 196
South Dakota	714, 750	1, 763, 790	[2] 269, 410	[2] 1, 304, 370
Tennessee	7, 716, 540	9, 018, 272	8, 280, 320	10, 047, 944
Texas	3, 772, 040	3, 658, 802	2, 698, 220	2, 534, 271
Utah	285, 170	318, 261	390, 480	416, 821
Vermont	244, 110	3, 831, 399	154, 170	3, 779, 673
Virginia	7, 052, 930	7, 938, 383	5, 668, 090	6, 615, 944
Washington	1, 965, 820	1, 809, 757	2, 081, 810	2, 499, 550
West Virginia	3, 223, 330	3, 238, 008	[2] 3, 157, 190	[2] 3, 324, 912
Wisconsin	4, 492, 740	6, 309, 369	[2] 4, 186, 140	[2] 6, 677, 382
Wyoming	179, 290	207, 122	259, 360	197, 641
Undistributed	4, 129, 560	5, 786, 191	3, 325, 210	5, 449, 206
	195, 884, 490	205, 002, 019	171, 343, 250	184, 320, 034

[1] Included under "Undistributed."

[2] To avoid disclosing confidential information, certain State totals are incomplete, the figures not included being combined under "Undistributed."

DIMENSION STONE

The term "dimension stone" is applied to blocks or slabs of natural stone cut to more or less definite shapes and sizes and used principally for the construction of masonry walls and for memorials. These products are quite distinct from crushed, broken, and pulverized stone, which comprises irregular fragments or grains sized chiefly by mechanical screening or air separation. Crushed and broken stone is covered in a later section of this chapter.

Dimension-stone producers may be divided into three main groups upon the basis of plant operation. The first group quarries stone and sells it as rough blocks or slabs; the second quarries stone and also manufactures it into finished products; and the third buys sawed slabs or rough blocks of stone and manufactures them into finished products but does not operate quarries. The Bureau of Mines statistical canvass covers the first and second groups but not the third group, which is more closely allied to the manufacturing than to the mining industries. Bureau of Mines statistics are compiled from reports of quantities and values of original sales; hence they include some material sold as rough blocks and some sold as finished products.

Total sales of dimension stone in 1943 declined 38 percent in quantity and 22 percent in value compared with 1942. These figures include slate, but details of this branch of the industry are given in the separate chapter on Slate.

The following table presents salient statistics for 1942 and 1943. The second table following is a historical record of the dimension stone industry from 1916.

Dimension stone sold or used by producers in the United States, 1942–43, by kinds and uses

Kind and use	1942	1943	
		Total	Percent of change
Granite:			
Building stone:			
Rough construction ... short tons	36,380	19,100	−47
Value	$132,276	$38.053	−71
Average per ton	$3 64	$1.99	−45
Cut stone, slabs, and mill blocks ... cubic feet	413,180	103,830	−75
Value	$1,030,223	$212,557	−79
Average per cubic foot	$2.49	$2.05	−18
Rubble ... short tons	215,730	65,850	−69
Value	$404,460	$120,296	−70
Monumental stone ... cubic feet	2,442,630	2,167,760	−11
Value	$7,092,572	$7,474,882	+5
Average per cubic foot	$2.90	$3.45	+19
Paving blocks ... number	1,986,910	637,370	−68
Value	$188,830	$66,542	−65
Curbing ... cubic feet	200,540	64,780	−68
Value	$232,392	$79,124	−66
Total:			
Quantity ... approximate short tons	522,170	283,880	−46
Value	$9,080,753	$7,991,454	−12
Basalt and related rocks (trap rock):			
Building stone:			
Rough construction ... short tons	4,880	101,330	+1,976
Value	$12,652	$105,669	+735
Average per ton	$2.59	$1.04	−60
Rubble ... short tons	7,870	24,000	+205
Value	$3,869	$13,104	+239
Total:			
Quantity ... short tons	12,750	125,330	+883
Value	$16,521	$118,773	+619

Dimension stone sold or used by producers in the United States, 1942–43, by kinds and uses—Continued

Kind and use	1942	1943	
		Total	Percent of change
Marble:			
Building stone (cut stone, slabs, and mill blocks)..cubic feet..	278, 460	137, 800	−51
Value	$1, 567, 736	$822, 853	−48
Average per cubic foot	$5. 63	$5. 97	+6
Monumental stone..cubic feet..	294, 610	373, 320	+27
Value	$1, 883, 994	$2, 256, 639	+20
Average per cubic foot	$6. 39	$6. 04	−5
Total:			
Quantity..approximate short tons..	48, 590	43, 390	−11
Value	$3, 451, 730	$3, 079, 492	−11
Limestone:			
Building stone:			
Rough construction..short tons..	96, 610	52, 680	−45
Value	$209, 313	$76, 468	−63
Average per ton	$2. 17	$1. 45	−33
Cut stone, slabs, and mill blocks..cubic feet..	1, 891, 930	719, 610	−62
Value	$1, 582, 254	$497, 752	−69
Average per cubic foot	$0. 84	$0. 69	−18
Rubble..short tons..	221, 180	124, 420	−44
Value	$324, 097	$198, 112	−39
Flagging..cubic feet..	100, 790	76, 960	−24
Value	$28, 823	$25, 516	−11
Total:			
Quantity..approximate short tons..	462, 970	237, 080	−49
Value	$2, 144, 487	$797, 848	−63
Sandstone:			
Building stone:			
Rough construction..short tons..	84, 980	24, 360	−71
Value	$174, 730	$50, 976	−71
Average per ton	$2. 06	$2. 09	+1
Cut stone, slabs, and mill blocks..cubic feet..	264, 610	221, 690	−16
Value	$391, 861	$312, 068	−20
Average per cubic foot	$1. 48	$1. 41	−5
Rubble..short tons..	77, 400	29, 870	−61
Value	$166, 369	$56, 672	−66
Paving blocks..number..	....	14, 520	....
Value	....	$791	....
Curbing..cubic feet..	114, 290	82, 080	−27
Value	$129, 198	$93, 099	−28
Flagging..cubic feet..	559, 060	325, 420	−42
Value	$251, 354	$153, 869	−39
Total:			
Quantity..approximate short tons..	232, 850	101, 380	−56
Value	$1, 113, 512	$667, 475	−40
Miscellaneous stone:[1]			
Building stone..cubic feet..	536, 450	370, 060	−31
Value	$825, 116	$690, 250	−16
Average per cubic foot	$1. 54	$1. 87	+21
Rubble..short tons..	22, 270	8, 630	−61
Value	$58, 995	$14, 716	−75
Flagging..cubic feet..	20, 140	13, 470	−33
Value	$10, 469	$7, 347	−30
Total:			
Quantity..approximate short tons..	68, 130	40, 660	−40
Value	$894, 580	$712, 313	−20
Total dimension stone, excluding slate:			
Quantity..approximate short tons..	1, 347, 460	831, 720	−38
Value	$16, 701, 583	$13, 367, 355	−20
Slate as dimension stone[2]..approximate short tons..	107, 030	73, 310	−32
Value	$2, 955, 807	$1, 946, 349	−34
Total dimension stone, including slate:			
Quantity..approximate short tons..	1, 454, 490	905, 030	−38
Value	$19, 657, 390	$15, 313, 704	−22

[1] Includes soapstone, mica schist, volcanic rocks, argillite, and other varieties that cannot be classified in the principal groups.

[2] Details of production, by uses, are given in the chapter on Slate in this volume.

Dimension stone sold or used by producers in the United States, 1916–43, by uses

Year	Building			Rubble		Monumental			Paving blocks		
	Cubic feet	Approximate short tons	Value	Short tons	Value	Cubic feet	Approximate short tons	Value	Number	Approximate short tons	Value
1916	25, 060, 040	2, 106, 050	$14, 677, 808	1, 034, 660	$825, 330	4, 553, 040	382, 960	$7, 372, 620	55, 061, 840	575, 250	$2, 730, 861
1917	17, 467, 920	1, 469, 120	12, 102, 914	915, 646	864, 321	4, 058, 626	341, 420	8, 102, 493	48, 907, 670	511, 060	2, 732, 434
1918	8, 616, 900	719, 200	7, 454, 973	482, 365	635, 895	4, 072, 343	343, 100	9, 912, 167	28, 516, 910	298, 650	1, 714, 011
1919	12, 764, 516	996, 840	10, 613, 683	601, 146	818, 565	4, 759, 995	399, 070	15, 042, 369	35, 630, 885	386, 530	2, 590, 690
1920	15, 870, 530	1, 266, 380	18, 948, 588	501, 570	791, 177	4, 549, 430	383, 910	17, 488, 765	35, 959, 200	389, 980	2, 898, 459
1921	17, 006, 210	1, 368, 650	18, 975, 819	445, 210	601, 208	2, 772, 000	230, 000	10, 353, 105	41, 588, 860	453, 130	3, 593, 373
1922	24, 262, 250	1, 929, 260	25, 749, 398	632, 100	947, 680	2, 974, 920	248, 270	10, 567, 110	31, 208, 800	326, 290	2, 685, 234
1923	26, 417, 020	2, 058, 930	32, 022, 717	882, 010	1, 298, 050	5, 100, 350	423, 610	16, 130, 230	45, 866, 480	462, 210	4, 003, 490
1924	28, 352, 380	2, 211, 750	33, 175, 656	864, 790	1, 160, 258	4, 750, 980	393, 550	15, 305, 386	41, 037, 570	375, 860	3, 578, 676
1925	30, 695, 310	2, 392, 420	35, 444, 809	1, 197, 170	2, 060, 868	4, 371, 380	363, 060	14, 404, 339	40, 143, 220	380, 710	3, 680, 687
1926	33, 467, 420	2, 609, 190	39, 922, 851	539, 670	917, 433	4, 335, 770	359, 950	14, 580, 929	39, 563, 180	366, 370	3, 399, 602
1927	32, 104, 200	2, 485, 120	40, 595, 127	809, 020	998, 108	4, 325, 390	358, 000	14, 978, 691	38, 705, 560	366, 740	3, 583, 400
1928	30, 795, 530	2. 453, 330	42, 769, 904	907, 890	1, 249, 703	4, 203, 780	347, 760	14, 966, 498	35, 426, 860	349, 290	3, 113, 526
1929	34, 761, 140	2, 647, 410	43, 905, 123	907, 810	1, 324, 681	4, 410, 140	366, 230	15, 848, 126	31, 849, 130	300, 360	2, 942, 991
1930	30, 169, 270	2, 321, 650	39, 111, 527	1, 066, 590	921, 937	3, 517, 870	290, 720	13, 157, 550	31, 586, 260	294, 560	2, 669, 511
1931	21, 461, 440	1, 669, 440	28, 111, 058	432, 230	592, 243	2, 869, 150	236, 650	9, 634, 168	22, 440, 590	197, 020	1, 938, 158
1932	16, 624, 000	1, 295, 590	20, 184, 566	179, 100	195, 650	2, 038, 370	168, 050	6, 244, 654	7, 583, 490	71, 860	620, 178
1933	11, 512, 490	870, 070	15. 337, 939	141, 590	186, 900	2, 006, 820	166, 260	5, 320, 880	5, 921, 580	59, 610	585, 708
1934	9, 026, 270	711, 090	8, 538, 847	293, 430	317, 640	2, 291, 890	186, 920	6, 226, 986	5, 895, 270	63, 740	618, 041
1935	10, 548, 740	830, 430	6, 755, 445	279, 100	375, 327	2, 169, 030	179, 380	6, 561, 231	8, 400, 940	78, 310	792, 502
1936	12, 727, 290	1, 001, 480	12, 585, 644	327, 300	350, 547	2, 852, 900	236, 180	8, 192, 825	7, 297, 683	75, 240	734, 554
1937	14, 685, 020	1, 158, 940	13, 142, 674	250, 620	333, 761	3, 018, 210	249, 050	8, 426, 623	7, 879, 944	73, 900	781, 259
1938	12, 777, 780	1, 005, 590	11, 894, 560	370, 060	426, 796	2, 450, 930	201, 680	7, 359, 184	4, 300, 930	38, 220	462, 729
1939	16, 980, 660	1, 353, 010	16, 008, 285	549, 240	525, 173	2, 571, 840	211, 400	7, 265, 575	[1] 2, 797, 560	[1] 25, 580	[1] 246, 084
1940	10, 642, 690	835, 790	11, 500, 699	916, 290	976, 872	2, 378, 820	196, 250	7, 378, 016	1, 868, 790	18, 650	240, 070
1941	10, 332, 860	816, 010	9, 817, 967	729, 490	870, 043	2, 882, 310	237, 440	9, 110, 846	[1] 2, 384, 110	[1] 20, 850	[1] 255, 276
1942	6, 444, 250	481, 200	5, 926, 161	544, 450	957, 790	2, 737, 240	225, 910	8, 976, 566	1, 986, 910	18, 540	188, 830
1943	3, 916, 900	318, 620	2, 806, 646	252, 770	402, 900	2, 541, 080	209, 840	9, 731, 521	651, 890	7, 030	67, 333

Dimension stone sold or used by producers in the United States, 1916–43, by uses—Continued

Year	Curbing			Flagging			Total	
	Cubic feet	Approximate short tons	Value	Cubic feet	Approximate short tons	Value	Approximate short tons	Value
1916	2, 900, 000	246, 370	$1, 611, 001	956, 000	78, 700	$409, 665	4, 423, 990	$27, 627, 285
1917	2, 367, 163	196, 800	1, 402, 980	1, 043, 738	86, 390	356, 327	3, 520, 436	25, 561, 469
1918	951, 650	80, 570	661, 188	798, 934	65, 900	373, 729	1, 989, 785	20, 751, 963
1919	1, 826, 663	150, 060	1, 288, 828	962, 173	78, 870	502, 871	2, 612, 516	30, 857, 006
1920	1, 508, 480	127, 710	1, 297, 058	688, 890	56, 460	463, 718	2, 726, 010	41, 887, 765
1921	2, 255, 770	183, 600	1, 859, 926	791, 660	65, 100	471, 837	2, 745, 090	35, 855, 268
1922	2, 867, 800	236, 030	2, 137, 193	650, 590	53, 580	406, 731	3, 425, 530	42, 493, 346
1923	3, 227, 810	252, 300	2, 936, 313	607, 600	43, 860	422, 059	4, 122, 920	56, 812, 859
1924	3, 815, 850	296, 070	3, 468, 821	810, 440	59, 840	560, 156	4, 201, 860	57, 248, 953
1925	5, 075, 620	393, 460	4, 313, 446	762, 280	55, 790	562, 344	4, 782, 610	60, 466, 493
1926	4, 409, 930	346, 020	4, 303, 280	902, 424	66, 330	657, 435	4, 287, 530	63, 781, 530
1927	4, 862, 580	378, 230	4, 939, 716	737, 680	55, 160	573, 736	4, 452, 270	65, 668, 778
1928	4, 832, 160	383, 070	4, 698, 313	932, 900	74, 900	717, 049	4, 516, 240	67, 514, 993
1929	4, 054, 700	336, 360	3, 843, 961	1, 129, 690	87, 750	666, 987	4, 645, 920	68, 531, 869
1930	3, 358, 583	262, 170	3, 176, 102	1, 095, 780	81, 680	705, 775	4, 317, 370	59, 742, 402
1931	2, 135, 690	171, 120	2, 241, 586	611, 920	50, 020	446, 525	2, 756, 480	42, 963, 738
1932	991, 240	79, 840	926, 190	320, 470	26, 450	206, 552	1, 820, 890	28, 377, 790
1933	688, 800	55, 780	618, 706	181, 070	14, 400	133, 827	1, 307, 710	22, 183, 960
1934	984, 400	78, 590	885, 040	299, 820	23, 440	190, 335	1, 357, 210	16, 776, 889
1935	858, 640	69, 340	793, 645	315, 700	24, 340	238, 933	1, 460, 900	15, 517, 083
1936	1, 528, 100	124, 450	1, 524, 220	531, 650	43, 870	377, 896	1, 808, 520	23, 765, 686
1937	1, 219, 100	98, 390	1, 139, 206	627, 010	50, 330	509, 014	1, 881, 230	24, 332, 537
1938	1, 375, 920	109, 170	1, 217, 091	488, 340	41, 400	417, 802	1, 766, 120	21, 778, 162
1939	[1] 1, 175, 260	[1] 94, 290	[1] 1, 080, 861	789, 410	64, 840	427, 048	2, 298, 360	25, 553, 026
1940	888, 740	71, 450	908, 204	884, 400	68, 300	413, 049	2, 106, 730	21, 416, 910
1941	[1] 820, 470	[1] 66, 240	[1] 896, 209	990, 900	76, 950	445, 493	1, 946, 980	21, 395, 834
1942	314, 830	25, 380	361, 590	679, 990	51, 980	290, 646	1, 347, 460	16, 701, 583
1943	147, 760	11, 640	172, 223	415, 850	31, 820	186, 732	831, 720	13, 367, 355

[1] To avoid disclosing confidential information, sandstone paving blocks are included under "Curbing."

BUILDING STONE

The use of stone as a building material predates the most ancient historic records, but its employment under the war conditions that prevailed in 1943 declined to the lowest point in its recorded history. The following table gives the quantity and value of each kind of building stone used in 1943.

Building stone sold or used by producers in the United States in 1943, by kinds

Kind	Rough			
	Construction		Architectural	
	Cubic feet	Value	Cubic feet	Value
Granite	227, 680	$38, 053	46, 570	$43, 464
Basalt	1, 192, 150	105, 669	....	....
Marble	....	....	41, 130	70, 736
Limestone	635, 090	76, 468	421, 930	139, 928
Sandstone	308, 990	50, 976	26, 720	18, 060
Miscellaneous	370, 060	690, 250	....	....
	2, 733, 970	961, 416	536, 350	272, 188

Kind	Finished				Total	
	Sawed [1]		Cut [1]			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
Granite	54, 280	$146, 150	2, 980	$22, 943	331, 510	$250, 610
Basalt	....	....	....	....	1, 192, 150	105, 669
Marble	23, 450	89, 963	73, 220	662, 154	137, 800	822, 853
Limestone	137, 760	95, 434	159, 920	262, 390	1, 354, 700	574, 220
Sandstone	141, 880	176, 628	53, 090	117, 380	530, 680	363, 044
Miscellaneous	....	....	....	....	370, 060	690, 250
	357, 370	508, 175	289, 210	1, 064, 867	3, 916, 900	2, 806, 646

[1] For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.

GRANITE

Sales of granite in the form of dimension stone declined 46 percent in quantity and 12 percent in value in 1943 compared with 1942. Rough construction and architectural stone sales declined to little more than half those recorded for 1942, while the output of dressed building stone fell to less than one-fifth of that recorded for 1942 in both quantity and value. The memorial stone branch of the industry, however, was maintained at relatively high levels. Rough stone sales dropped moderately in quantity, but the value was higher than in 1942. Dressed stone gained both in quantity and value. Curbing and paving-block production dropped to the lowest points ever recorded.

Granite (dimension stone) sold or used by producers in the United States in 1943, by States and uses

State	Active plants	Building								Monumental				Paving blocks		Curbing		Total	
		Rough				Dressed		Rubble		Rough		Dressed							
		Construction		Architectural															
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Cubic feet	Value	Number	Value	Cubic feet	Value	Short tons (approximate)	Value
California	12	(1)	(1)							20,770	$52,018	9,060	$81,043			(1)	(1)	2,540	$133,527
Colorado	1							(1)	(1)	2,100	4,630	(1)	(1)					450	10,182
Connecticut	4	150	$1,432	130	$196			350	$2,274	950	3,803	2,780	33,208			1,470	$1,886	940	42,799
Georgia	17	760	1,010	17,130	20,849	40	$693	15,190	18,005	496,800	630,672	144,570	689,776	13,300	$898	11,300	8,531	71,670	1,370,434
Maine	6	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	11,620	59,480
Maryland	4	(1)	(1)					(1)	(1)							(1)	(1)	31,600	69,042
Massachusetts	4			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	13,040	302,518
Minnesota	20			5,700	5,532					142,320	206,715	31,180	184,635					14,870	396,882
Missouri	2	600	2,100							21,280	42,890							2,380	44,990
Montana	4									850	1,816	200	1,950					90	3,766
New Hampshire	3			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)					1,140	66,333
New York	3	(1)	(1)					(1)	(1)					(1)	(1)	(1)	(1)	6,690	16,846
North Carolina	7			(1)	(1)	(1)	(1)	1,630	6,630	16,710	30,526	(1)	(1)	(1)	(1)	(1)	(1)	6,500	161,233
Oklahoma	6			(1)	(1)	(1)	(1)	(1)	(1)	7,880	28,556	29,370	298,332			(1)	(1)	3,340	327,428
Pennsylvania	10	9,170	15,686					5,540	6,628	(1)	(1)	(1)	(1)	(1)	(1)			18,250	154,703
Rhode Island	3									57,060	162,208							4,650	162,208
South Carolina	3									(1)	(1)					(1)	(1)	(1)	(1)
South Dakota	6			3,550	3,551					40,990	56,660	94,340	854,252					11,250	914,463
Texas	7	1,880	2,824							16,000	42,153	1,500	14,000					3,320	58,977
Vermont	5			7,630	5,526					635,350	2,267,777							52,080	2,273,303
Virginia	2							(1)	(1)	(1)	(1)			(1)	(1)			(1)	(1)
Washington	3							(1)	(1)	(1)	(1)	(1)	(1)					490	10,353
Wisconsin	12									(1)	(1)	68,100	834,217	(1)	(1)			8,730	923,229
Undistributed		6,540	15,001	12,430	7,810	57,220	168,400	43,140	86,759	270,420	636,877	57,180	316,168	624,070	65,644	52,010	68,707	18,240	488,758
	144	19,100	38,053	46,570	43,464	57,260	169,093	65,850	120,296	1,729,480	4,167,301	438,280	3,307,581	637,370	66,542	64,780	79,124	283,880	7,991,454
Average unit value			$1.99		$0.93		$2.95		$1.83		$2.41		$7.55		$0.10		$1.22		$28.15
Short tons (approximate)		(2)		3,840		4,710				141,980		36,150		6,880		5,370			

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[1] Included under "Undistributed."

[2] 227,680 cubic feet (approximate).

The following tables show sales of monumental granite in the Quincy (Mass.) and Barre (Vt.) centers.

Monumental granite sold by quarrymen at Quincy, Mass., 1939–43 [1]

Year	Active plants	Cubic feet	Value
1939	3	25,620	$61,955
1940	3	24,540	60,139
1941	3	26,670	65,062
1942	3	16,738	$46,079
1943	1	12,603	45,274

[1] Quincy granite is sold also for construction, curbing, rubble, riprap, and crushed stone.

Monumental granite sold by quarrymen in the Barre district, Vermont, 1939–43 [1]

Year	Cubic feet	Value
1939	684,310	$2,029,801
1940	601,190	2,039,960
1941	764,280	2,431,152
1942	612,220	$2,035,327
1943	635,350	2,267,777

[1] Barre granite is sold also for construction and crushed stone.

Estimated output of monumental granite in the Barre district, Vermont, 1941–43 [1]

	1941	1942	1943
Total quarry output, rough stock……cubic feet	668,544	750,000	578,148
Shipped out of Barre district in rough……do	133,709	150,000	115,630
Manufactured in Barre district……do	534,835	600,000	462,518
Light stock consumed in district……do	334,272	468,750	289,074
Dark stock consumed in district……do	200,563	281,250	173,444
Number of cutters in district	1,295	1,295	1,204
Average daily wage	$9.00	$9.50	$9.50
Average number of days worked	230	230	222
Total pay roll for year	$3,729,600	$2,829,575	$2,539,236
Estimated overhead	1,864,800	1,414,787	1,269,618
Estimated value of light stock	1,398,605	1,640,625	1,318,900
Estimated value of dark stock	1,097,367	1,265,625	1,008,146
Estimated polishing cost	422,988	474,525	365,794
Output from saws	140,996	158,175	121,931
Total value of granite	8,654,356	7,783,312	6,623,625

[1] Through the kindness of the Granite Manufacturers' Association, Barre, figures covering the entire granite industry of the Barre district are given in this table to supplement figures of sales reported by quarrymen.

BASALT AND RELATED ROCKS (TRAP ROCK)

Because of its dark color, basalt is not employed extensively for building. Unusually large quantities, however, were used for rough construction in 1943, although the value per ton dropped from $2.59 to only $1.04. Sales of rubble also gained greatly, and the unit value was higher than in 1942. Basalt and related rocks are used to some extent for memorials, but such stones are classed in trade as black granite and are therefore included with the figures for monumental granite.

Basalt and related rocks (trap rock) (dimension stone) sold or used by producers in the United States in 1943, by States and uses

State	Active plants	Building stone				Total	
		Rough construction		Rubble		Short tons	Value
		Short tons	Value	Short tons	Value		
Connecticut	1	(1)	(1)			(1)	(1)
Hawaii	2	(1)	(1)	(1)	(1)	(1)	(1)
Idaho	1			(1)	(1)	(1)	(1)
Montana	1			(1)	(1)	(1)	(1)
New Jersey	2	200	$100	110	$113	310	$213
Oregon	1	670	4,420			670	4,420
Pennsylvania	1	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed		100,460	101,149	23,890	12,991	124,350	114,140
	9	[2] 101,330	105,669	24,000	13,104	125,330	118,773
Average unit value			$1.04		$0.55		$0.95

[1] Included under "Undistributed."

[2] 1,192,150 cubic feet (approximate).

MARBLE

Sales of marble in 1943 declined 11 percent in both quantity and value compared with 1942. The greatest decrease—51 percent in quantity and 48 percent in value—was in marble used for building purposes. War construction—which, as in 1942, dominated the building program—includes very few structures that employ marble. The erection of public, educational, and commercial buildings of permanent types, such as are built under peacetime conditions, has been virtually at a standstill since the war began; until such peacetime building is resumed, the building-marble industry will lag. On the other hand, the monumental branch of the industry, activity of which is governed largely by buying power of the public, made substantial gains in 1943, registering a 27-percent increase in quantity and a 20-percent increase in value of sales. The average value per cubic foot of building marble increased 6 percent, whereas that of monumental marble declined 5 percent.

Marble (dimension stone) sold by producers in the United States, 1942–43, by uses

Use	1942		1943	
	Cubic feet	Value	Cubic feet	Value
Building stone:				
Rough:				
Exterior	(1)	(1)	14,850	$25,152
Interior [2]	[1] 58,800	[1] $111,722	26,280	45,584
Finished:				
Exterior	66,590	260,768	6,620	13,953
Interior	153,070	1,195,246	90,050	738,164
Total exterior	[1] 66,590	[1] 260,768	21,470	39,105
Total interior	[1] 211,870	[1] 1,306,968	116,330	783,748
Total building stone	278,460	1,567,736	137,800	822,853
Monumental stone:				
Rough	18,450	23,489	373,320	2,256,639
Finished	276,160	1,860,505		
Total monumental stone	294,610	1,883,994	373,320	2,256,639
Total building and monumental	573,070	3,451,730	511,120	3,079,492
Approximate short tons	48,590		43,390	

[1] A small quantity of rough exterior building marble included under rough interior building marble.

[2] Includes onyx for the manufacture of mantels, lamp bases, desk sets, clock cases, and novelties.

Marble (dimension stone) sold by producers in the United States in 1943, by States and uses

State	Active plants	Building		Monumental		Total		
						Quantity		
		Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value
Alabama	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arkansas	1	4,100	$3,485	250	$600	4,350	370	$4,085
Georgia	1	5,900	52,115	197,670	1,151,042	203,570	17,300	1,203,157
Minnesota	1	(1)	(1)			(1)	(1)	(1)
Missouri	2	5,800	48,228	10,910	33,532	16,710	1,380	81,760
North Carolina	1			(1)	(1)	(1)	(1)	(1)
Tennessee	5	76,220	450,204	21,270	196,722	97,490	8,290	646,926
Utah [2]	1	1,970	4,916			1,970	150	4,916
Vermont	4	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed		43,810	263,905	143,220	874,743	187,030	15,900	1,138,648
	18	137,800	822,853	373,320	2,256,639	511,120	43,390	3,079,492
Average unit value			$5.97		$6.04			[3] $6.02
Short tons (approximate)		11,680		31,710				

[1] Included under "Undistributed."
[2] Figures represent onyx rough blocks for the manufacture of mantels, lamp bases, desk sets, clock cases, and novelties.
[3] Average value per cubic foot.

LIMESTONE

Limestone fabricated as dimension stone is employed almost exclusively for building purposes. It is the most widely used building stone in the United States, and under normal conditions many million cubic feet are employed for both interiors and exteriors of public buildings of all kinds, including churches, museums, schools, and college buildings, as well as commercial and other privately owned structures. With virtual cessation during recent years of all types of construction that ordinarily use building stone the industry has experienced a serious decline, and there is no hope of recovery until peace prevails. The Indiana industry, centered at Bedford and Bloomington, supplied 79 percent of the rough architectural and finished (sawed and cut) limestone sold in 1943. Total sales in 1943 were 49 percent less in quantity and 63 percent less in value than in 1942. Unit prices of rough construction and of finished (cut and sawed) stone declined, but those of rough architectural stone and rubble increased.

Limestone (dimension stone) sold or used by producers in the United States in 1943, by States and uses

State	Active plants	Building								Flagging		Total	
		Rough				Finished (cut and sawed)		Rubble					
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Short tons (approximate)	Value
Alabama	1							(¹)	(¹)			(¹)	(¹)
Arizona	1							(¹)	(¹)			(¹)	(¹)
California	5	(¹)	(¹)					(¹)	(¹)			5,720	$6,167
Illinois	8	1,000	$1,415					2,450	$1,883	5,960	$2,380	3,930	5,678
Indiana	12			288,750	$94,500	276,780	$303,053	26,500	19,928			67,500	417,481
Iowa	4	(¹)	(¹)					(¹)	(¹)	(¹)	(¹)	710	1,051
Kansas	19	2,090	2,945	37,630	10,787			4,490	4,063			9,780	17,795
Kentucky	3	(¹)	(¹)					(¹)	(¹)			2,670	2,584
Maryland	1	(¹)	(¹)					(¹)	(¹)			(¹)	(¹)
Michigan	2	(¹)	(¹)					(¹)	(¹)			(¹)	(¹)
Minnesota	5	3,000	9,000	2,550	2,240	700	1,800	1,850	1,730	240	175	5,410	14,945
Missouri	8	7,820	11,342			6,700	19,798	4,910	9,660	11,500	3,900	14,210	44,700
New York	2							(¹)	(¹)			(¹)	(¹)
North Carolina	1							(¹)	(¹)			(¹)	(¹)
Ohio	2	(¹)	(¹)					(¹)	(¹)			(¹)	(¹)
Pennsylvania	11	4,390	8,017					5,460	7,650	6,440	688	10,380	16,355
Puerto Rico	4	(¹)	(¹)									(¹)	(¹)
Tennessee	1							(¹)	(¹)			(¹)	(¹)
Texas	2	(¹)	(¹)			(¹)	(¹)	(¹)	(¹)			(¹)	(¹)
Vermont	1							(¹)	(¹)			(¹)	(¹)
Virginia	1	(¹)	(¹)					(¹)	(¹)			(¹)	(¹)
West Virginia	2	(¹)	(¹)					(¹)	(¹)			(¹)	(¹)
Wisconsin	18	4,450	9,911	93,000	32,401	(¹)	(¹)	6,100	7,409	(¹)	(¹)	22,490	71,064
Undistributed		29,930	33,838			13,500	33,173	72,660	145,789	52,800	18,373	94,280	200,028
	114	52,680	76,468	421,930	139,928	297,680	357,824	124,420	198,112	76,960	25,516	237,080	797,848
Average unit value			$1.45		$0.33		$1.20		$1.59		$0.33		$3.37
Short tons (approximate)		(²)		31,770		21,980				6,230			

[1] Included under "Undistributed."

[2] 635,090 cubic feet (approximate).

The following tables show detailed figures, by uses, for limestone produced near Bedford and Bloomington, Ind., and Carthage, Mo., over a 5-year period.

Limestone sold by producers in the Indiana oolitic-limestone district, 1939–43, by classes

Year	Construction					
	Rough block		Sawed and semifinished		Cut	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1939	2,462,860	$845,252	1,277,730	$784,247	1,534,530	$2,470,724
1940	1,395,910	425,990	994,370	573,368	831,900	1,125,825
1941	1,047,000	309,444	1,029,970	567,706	826,510	1,177,651
1942	526,620	160,117	135,360	98,518	766,320	1,070,164
1943	288,750	94,500	135,580	92,034	141,200	211,019

Year	Construction—Continued			Other uses		Total	
	Total						
	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
1939	5,275,120	383,000	$4,100,223	247,680	$117,200	630,680	$4,217,423
1940	3,222,180	233,600	2,125,183	79,730	40,676	313,330	2,165,859
1941	2,903,480	210,500	2,054,801	135,610	98,547	346,110	2,153,348
1942	1,428,300	103,500	1,328,800	87,770	69,404	191,270	1,398,204
1943	565,530	41,000	397,553	150,710	181,303	191,710	578,856

Indiana limestone sold by mills in the district not operated by quarry companies and by mills of quarry companies from stock obtained at quarries other than their own, 1939–43, by classes

Year	Sawed and semifinished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1939	108,360	$50,338	1,839,520	$2,966,530	1,947,880	$3,016,868
1940	272,510	182,239	1,034,100	1,629,273	1,306,610	1,811,512
1941	86,690	47,502	690,250	1,043,774	776,940	1,091,276
1942	[1] 54,680	[1] 17,128	[1] 449,950	[1] 746,312	504,630	763,440
1943 [2]	(1)	(1)	[1] 232,700	[1] 362,757	232,700	362,757

[1] A small amount of sawed and semifinished stone included under cut stone.

[2] No stone sold from mills of quarry companies from stock obtained at quarries other than their own.

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1939–43, by classes

Year	Dimension stone (rough and dressed)							Other uses		Total	
	Building		Monumental		Total						
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
1939	180, 040	$448, 966	8, 400	$18, 603	188, 440	15, 730	$467, 569	60, 580	$94, 215	76, 310	$561, 784
1940	124, 180	248, 498	8, 430	18, 844	132, 610	11, 070	267, 342	90, 390	128, 627	101, 460	395, 969
1941	50, 000	219, 361	8, 680	19, 868	58, 680	4, 900	239, 229	253, 030	414, 770	257, 930	653, 999
1942	22, 580	100, 581	9, 590	23, 271	32, 170	2, 650	123, 852	436, 600	538, 697	439, 250	662, 549
1943	11, 950	66, 326	10, 910	33, 532	22, 860	1, 910	99, 858	299, 730	487, 519	301, 640	587, 377

SANDSTONE

Sales of sandstone declined 56 percent in quantity and 40 percent in value in 1943 compared with 1942. All branches of the industry experienced serious declines, the greatest of which—71 percent in both quantity and value—was in sales of rough construction stone. The average value of this product increased from $2.06 to $2.09 a ton. Cut stone, slabs, and mill blocks declined 16 percent in quantity and 20 percent in value, and the unit value dropped from $1.48 to $1.41 a cubic foot. Curbing and flagging sales were far below those of 1942. The paving-block branch of the industry is insignificant. The number of active sandstone plants dropped from 82 to 50.

Ohio is the leading producer, its quarries supplying 63 percent of the total value of output in 1943. The largest quarries are near Amherst, west of Cleveland. Pennsylvania, New York, Tennessee, and West Virginia follow in order of sales value.

The second table following presents a 21-year history of the bluestone industry. This type of sandstone, which splits readily into smooth sheets, is well adapted for building stone, curbing, and flagging. Sales in 1943 were little more than half those of 1942.

Sandstone (dimension stone) sold or used by producers in the United States in 1943, by States and uses

State	Active plants	Building								Rubble		Paving blocks		Curbing		Flagging		Total	
		Rough construction		Rough architectural		Dressed													
						Sawed		Cut											
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Number	Value	Cubic feet	Value	Cubic feet	Value	Short tons (approximate)	Value
Arkansas	1									(1)	(1)							(1)	(1)
California	3	(1)	(1)							(1)	(1)					(1)	(1)	4,410	$11,554
Colorado	2	(1)	(1)	(1)	(1)					(1)	(1)					(1)	(1)	(1)	(1)
Connecticut	1	(1)	(1)															(1)	(1)
Georgia	1															(1)	(1)	(1)	(1)
Illinois	1									(1)	(1)							(1)	(1)
Kansas	1									10	$7					2,100	$1,214	170	1,221
Minnesota	1							1,000	$3,278									80	3,278
New York [2]	9	650	$742					(1)	(1)	200	114	14,520	$791	(1)	(1)	30,920	23,136	6,010	60,754
Ohio	6	(1)	(1)	(1)	(1)	141,880	$176,628	39,470	89,102					(1)	(1)	209,700	62,990	35,400	420,698
Pennsylvania [3]	11	15,730	21,116					(1)	(1)	(1)	(1)					19,450	21,128	21,050	61,441
South Dakota	3									9,990	7,296							9,990	7,296
Tennessee	2									3,700	20,286					43,780	34,504	7,110	54,790
Virginia	4	2,050	6,550													3,930	1,544	2,360	8,094
Washington	1	20	312							50	108							70	420
West Virginia	3	3,750	14,274							9,050	16,032							12,800	30,306
Undistributed		2,160	7,982	26,720	$18,060			12,620	25,000	6,870	12,829			82,980	$93,099	15,540	9,353	1,930	7,623
	50	24,360	50,976	26,720	18,060	141,880	176,628	53,090	117,380	29,870	56,672	14,520	791	82,980	93,099	325,420	153,869	101,380	667,475
Average unit value			$2.09		$0.68		$1.24		$2.21		$1.90		$0.05		$1.12		$0.47		$6.58
Short tons (approximate)		(4)		1,940		10,290		4,000				150		6,270		24,500			

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[1] Included under "Undistributed."

[2] Includes 61,400 cubic feet of bluestone (approximately 5,190 short tons) valued at $59,153 sold for construction, curbing, and flagging.

[3] Includes 38,440 cubic feet of bluestone (approximately 3,320 short tons) valued at $32,906 sold for construction and flagging.

[4] 308,990 cubic feet (approximate).

Bluestone (dimension stone) sold or used in the United States, 1923–43 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1923	618,360	$747,422	1934	181,960	$168,720
1924	769,240	875,734	1935	215,150	203,537
1925	987,300	910,585	1936	343,040	332,749
1926	692,640	885,597	1937	308,740	346,349
1927	815,730	1,000,217	1938	329,670	369,857
1928	891,190	1,014,843	1939	254,440	319,405
1929	670,020	773,532	1940	256,900	272,501
1930	611,240	749,703	1941	284,190	252,313
1931	356,210	427,801	1942	183,470	166,787
1932	185,960	185,643	1943	99,840	92,059
1933	116,246	123,867			

[1] New York and Pennsylvania are the only States that produce bluestone.

MISCELLANEOUS STONE

The following table gives data on certain types of dimension stone not included in the major groups already discussed. The principal varieties are mica schist, argillite, various light-color volcanic rocks, soapstone, and greenstone. The quantity sold in 1943 decreased 40 percent and the value 20 percent compared with 1942.

Miscellaneous varieties of stone (dimension stone) sold or used by producers in the United States in 1943, by States and uses

State	Active plants	Building				Flagging		Total	
		Rough and dressed		Rubble					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	3	(1)	(1)	(1)	(1)			2,430	$8,200
Georgia	1					(1)	(1)	(1)	(1)
Maryland	4	2,340	$7,726	3,310	$5,048	280	$1,570	5,930	14,344
New York	1					(1)	(1)	(1)	(1)
North Carolina	1			(1)	(1)			(1)	(1)
Pennsylvania	6	16,460	32,719	2,010	840			18,470	33,559
Virginia	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed		12,140	649,805	3,310	8,828	810	5,777	13,830	656,210
	18	[2] 30,940	690,250	8,630	14,716	[2] 1,090	7,347	40,660	712,313
Average unit value			$22.31		$1.71		$6.74		$17.52

[1] Included under "Undistributed."
[2] Building stone (rough and dressed), approximately 370,060 cubic feet; flagging, approximately 13,470 cubic feet.

TRENDS IN USE OF DIMENSION STONE

Figure 1 shows graphically the history of production of dimension stone, by kinds, for a 28-year period. All types of stone follow closely the general trends of national peacetime prosperity, but they decline greatly during wars.

Figure 2 traces the history of production of all building stones and of the principal variety—limestone—in their relation to nonresidential building, the class of construction using stone most extensively. In peacetime, building stone follows the general trend of nonresidential construction, falling to low levels in depressions and reaching high points in periods of national prosperity when the building trades are vigorous. The striking divergence of the lines in figure 2 since 1941 illustrates the blighting effect of war on the building-stone industries.

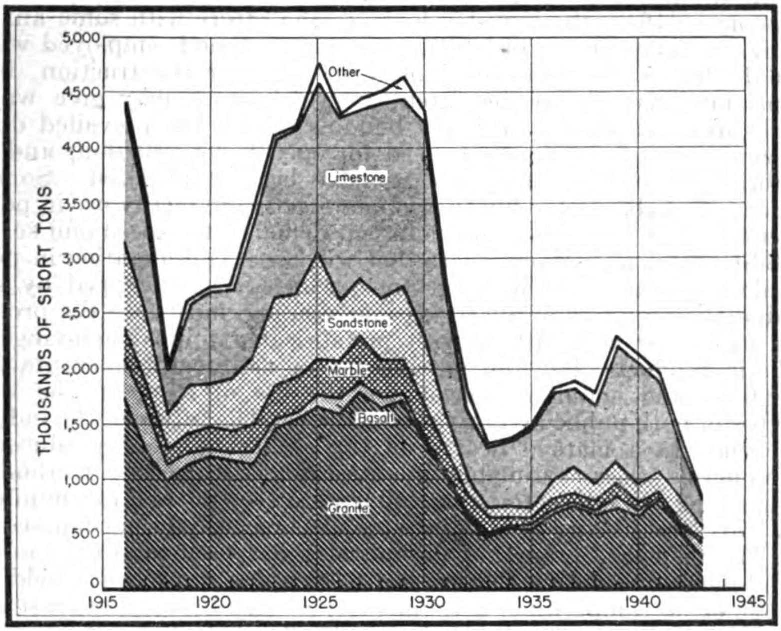

FIGURE 1.—Sales of dimension stone in the United States, by kinds, 1916–43.

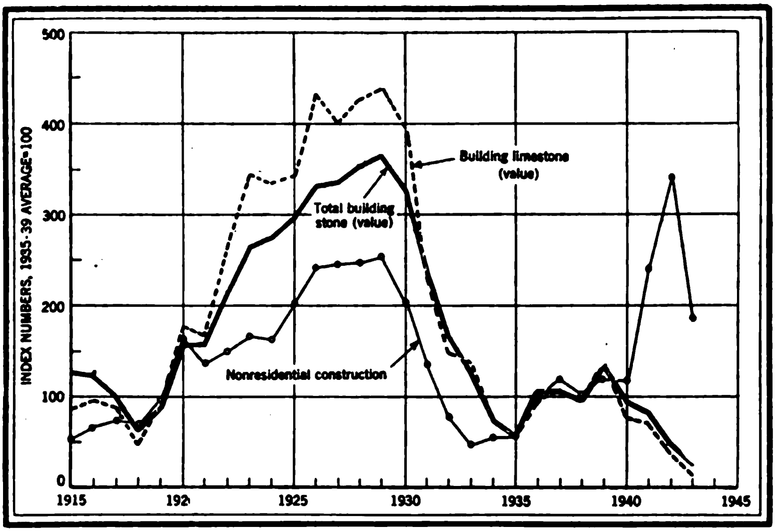

FIGURE 2.—Sales of all building stone and building limestone compared with nonresidential construction (public and private), 1915–43. Data on nonresidential building construction from Bureau of Foreign and Domestic Commerce.

POST-WAR OUTLOOK

As the use of building stone reached the lowest point in its recorded history in 1943, the industry looks to the future with some anxiety. The permanent types of buildings in which stone is employed will no doubt find their accustomed place in post-war construction, but a question arises as to the extent to which stone may give way to substitute materials. Military building, which has prevailed during recent years, has created a need for speedy construction, and prefabrication methods and designs have been emphasized. Some of them no doubt are too flimsy and unattractive to justify use in permanent structures, but out of the urgent demands for speed and serviceability there may evolve ideas that will merit consideration in peacetime construction. Building stone, which is handicapped by slow, laborious processes of quarrying and shaping, must face the prospect of increasing competition with prefabricated units employing synthetic products, but the advantages of architectural adaptability, dignity, and endurance encourage the use of stone in the better types of both public and private building. The future of the industry depends to a marked degree on the ability of stone producers to popularize these estimable qualities and to perfect methods of quarrying and fabrication that will tend to keep the cost to a minimum. A statistical history of building stone has recently been compiled.[1]

The memorial branch of the industry has been retarded less than building stone during the war; as it occupies an exclusive field with little or no competition, a volume of post-war business at least equal to that of pre-war years is to be expected.

CRUSHED AND BROKEN STONE

Over 170,000,000 short tons of crushed and broken stone were sold in 1943, exclusive of that used for making cement and lime. Sales decreased 12 percent in quantity and 9 percent in value compared with 1942. The average value at point of origin increased 3 cents a ton.

The following table of salient statistics shows the quantity and value of crushed and broken stone sold during 1942 and 1943, by uses. Detailed data on asphaltic stone and slate granules and flour are given in the chapters on Asphalt and Slate.

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[1] Bowles, Oliver, and Jensen, Nan C., Trends in Consumption and Prices of Building Materials: Bureau of Mines Inf. Circ. 7265, 1943, pp. 14-17.

Crushed and broken stone sold or used by producers in the United States, 1942–43, by principal uses

Use	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Concrete and road metal	107,701,010	$105,583,801	$0.98	82,412,380	$83,397,757	$1.01
Railroad ballast	17,566,640	10,810,977	.62	17,235,700	11,346,272	.66
Metallurgical	30,262,910	24,152,113	.80	31,570,650	24,505,567	.78
Alkali works	6,350,450	3,005,483	.47	6,867,190	4,189,940	.61
Riprap	8,763,980	9,779,249	1.12	4,950,470	4,834,513	.98
Agricultural	13,745,400	16,993,254	1.24	14,521,670	19,057,120	1.31
Refractory (ganister, mica schist, dolomite, soapstone)	2,718,090	3,999,929	1.47	2,707,860	4,577,047	1.69
Asphalt filler	439,430	1,026,138	2.34	440,510	887,908	2.02
Calcium carbide works	430,600	399,169	.93	526,920	538,425	1.02
Sugar factories	625,520	986,210	1.58	347,320	658,209	1.90
Glass factories	434,080	656,775	1.51	504,930	811,991	1.61
Paper mills	435,200	760,332	1.75	384,960	699,266	1.82
Other uses	5,063,720	10,147,006	2.00	8,040,970	15,448,664	1.92
	194,537,030	188,300,436	.97	170,511,530	170,952,679	1.00
Portland cement (including "cement rock")[1]	47,657,000	(2)		35,867,000	(2)	
Natural cement ("cement rock")[1]						
Lime[3]	12,208,000	(2)		13,193,000	(2)	
Total stone	254,402,000	(2)		219,572,000	(2)	
Asphaltic stone	935,295	[4] 3,367,279	[4] 3.60	835,648	3,096,753	3.71
Slate granules and flour	483,740	3,404,416	7.04	395,550	2,923,888	7.3

[1] Value reported as cement in chapter on Cement.
[2] No value available for stone used in manufacture of cement and lime.
[3] Value reported as lime in chapter on Lime.
[4] Corrected figure.

The first and second tables following show the tonnage and value of stone used for concrete aggregate, road construction, and railroad ballast for a series of years and by States for 1943; the third is a historical table covering the output of crushed and broken stone, beginning with 1916.

Concrete and road metal and railroad ballast sold or used by producers in the United States, 1939–43

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	96,894,220	$88,988,217	6,996,800	$4,970,058	103,891,020	$93,958,275
1940	92,814,090	86,331,273	7,454,300	5,231,815	100,268,390	91,563,088
1941	110,192,610	106,985,808	10,771,300	7,536,451	120,963,910	114,522,259
1942	107,701,010	105,583,801	17,566,640	10,810,977	125,267,650	116,394,778
1943	82,412,380	83,397,757	17,235,700	11,346,272	99,648,080	94,744,029

Concrete and road metal and railroad ballast sold or used by producers in the United States in 1943, by States

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	[1] 212,880	[1] $216,217	(2)	(2)	[1] 212,880	[1] $216,217
Alaska	(2)	(2)			(2)	(2)
Arizona	[1] 23,890	[1] 34,609			[1] 23,890	[1] 34,609
Arkansas	907,630	880,756	[1] 43,900	[1] $46,797	[1] 951,530	[1] 927,553
California	6,129,280	4,093,551	141,430	90,783	6,270,710	4,184,334
Colorado	76,210	93,902	(2)	(2)	[1] 76,210	[1] 93,902
Connecticut	[1] 969,140	[1] 1,048,782	91,410	82,273	[1] 1,060,550	[1] 1,131,055
Delaware	(2)	(2)			(2)	(2)
Florida	[1] 6,453,000	[1] 5.581,768	244,500	115,713	[1] 6,697,500	[1] 5,697,481
Georgia	[1] 1,457,000	[1] 1,699,472	(2)	(2)	[1] 1,457,000	[1] 1,699,472
Hawaii	(2)	(2)	(2)	(2)	(2)	(2)
Idaho	(2)	(2)			(2)	(2)
Illinois	[1] 6,119,780	[1] 5,502,333	743,750	559,139	[1] 6,863,530	[1] 6,061,472
Indiana	3,753,530	3,610,730	348,630	273,790	4,102,160	3,884,520
Iowa	2,022,820	2,194,317	84,760	47,998	2,107,580	2,242,315
Kansas	1,227,150	1,390,628	518,740	469,646	1,745,890	1,860,274
Kentucky	2,782,710	2,825,893	565,000	379,358	3,347,710	8,205,251
Louisiana	(2)	(2)			(2)	(2)
Maine	[1] 22,230	[1] 38,085			[1] 22,230	[1] 38,085
Maryland	1,044,640	1.311,981	192,740	225,316	1,237,380	1,537,297
Massachusetts	[1] 820,720	[1] 945,566	279,120	280,394	[1] 1,099,840	[1] 1,225,960
Michigan	1,310,730	905,732	122,330	96,769	1,433,060	1,002,501
Minnesota	341,450	349,253	59,060	66,579	400.510	415,832
Mississippi	(2)	(2)			(2)	(2)
Missouri	[1] 3,077,690	[1] 3,123,157	1,140,560	361,472	[1] 4,218,250	[1] 3,484,629
Montana	119,640	86,704	(2)	(2)	[1] 119,640	[1] 86,704
Nebraska	159,340	179,483	(2)	(2)	[1] 159,340	[1] 179,483
Nevada	35,420	53,188	(2)	(2)	[1] 35,420	[1] 53,188
New Hampshire	68,250	95,230			68,250	95,230
New Jersey	2,190,900	2,611.094	66,970	71,522	2,257,870	2,682,616
New Mexico	11,380	19.721	(2)	(2)	[1] 11,380	[1] 19,721
New York	[1] 4,657,940	[1] 5,047,588	[1] 1,157,660	[1] 979,164	[1] 5,815,600	[1] 6,026,752
North Carolina	3,557,960	3,536,054	462,620	483,337	4,020,580	4,019,891
Ohio	[1] 5,782,260	[1] 5,130.238	1,109,580	873,314	[1] 6,891,840	[1] 6,003,552
Oklahoma	2,024,650	1,512,473	3,414,410	632,288	5,439,060	2,144,761
Oregon	[1] 1,306,840	[1] 1,614,165	[1] 32,720	[1] 22,771	[1] 1,339,560	[1] 1,636,936
Pennsylvania	6,176,590	6,806,668	885,650	884,014	7,062,240	7,690,682
Puerto Rico	(2)	(2)	(2)	(2)	(2)	(2)
Rhode Island	155,230	232,427			155,230	232,427
South Carolina	981,810	1,197,025	514,240	497,254	1,496,050	1,694,279
South Dakota	[1] 178,600	[1] 258,176			[1] 178,600	[1] 258,176
Tennessee	[1] 5,598,140	[1] 6,738,105	720,130	530,845	[1] 6,318,270	[1] 7,268,950
Texas	1,339,540	1,366,330	803,120	495,864	2,142,660	1,862,194
Utah	35,460	51,011	(2)	(2)	[1] 35,460	[1] 51,011
Vermont	8,860	16,297			8,860	16,297
Virginia	[1] 2,626,290	[1] 2,900,042	746,170	631,019	[1] 3,372,460	[1] 3,531,061
Washington	[1] 1,153,920	[1] 1,376,215	367,600	332,664	[1] 1,521,520	[1] 1,708,879
West Virginia	[1] 534,740	[1] 615,796	500,110	463,120	[1] 1,034,850	[1] 1,078,916
Wisconsin	2,402,090	2,051,481	[1] 118,570	[1] 80,749	[1] 2,520,660	[1] 2,132,230
Wyoming	(2)	(2)	(2)	(2)	(2)	(2)
Undistributed	2,554,050	4,055,514	1,760,220	1,272,320	4,314,270	5,327,834
	82,412,380	83,397,757	17,235,700	11,346,272	99,648,080	94,744,029

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[1] To avoid disclosing confidential information certain totals are somewhat incomplete, the figures not included being combined under "Undistributed."

[2] Included under "Undistributed."

Crushed stone sold or used in the United States, 1916–43, by uses

Year	Riprap		Concrete and road metal		Railroad ballast		Fluxing stone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1916	5, 315, 340	$3, 635, 167	37, 420, 566	$24, 289, 111	10, 655, 015	$5, 173, 441	26, 458, 329	$13, 946, 882
1917	2, 933, 877	2, 208, 373	31, 680, 334	24, 271, 086	8, 605, 043	4, 794, 423	28, 640, 044	18, 679, 213
1918	2, 273, 852	1, 923, 154	22, 103, 627	22, 380, 744	7, 269, 715	5, 570, 649	26, 787, 085	23, 512, 635
1919	1, 751, 677	1, 922, 823	26, 868, 225	30, 553, 404	6, 805, 114	5, 851, 782	21, 315, 300	19, 419, 438
1920	2, 211, 170	2, 431, 723	32, 823, 900	43, 035, 030	7, 541, 960	7, 811, 663	25, 090, 350	26, 635, 977
1921	1, 813, 590	1, 694, 206	36, 765, 790	45, 338, 984	6, 437, 050	6, 378, 494	10, 669, 000	9, 457, 946
1922	2, 048, 580	1, 768, 939	42, 426, 500	47, 582, 758	7, 337, 240	6, 547, 419	18, 718, 000	14, 247, 024
1923	3, 185, 900	2, 989, 068	51, 047, 900	58, 356, 094	11, 274, 810	9, 572, 557	25, 602, 450	20, 377, 138
1924	3, 265, 130	3, 634, 439	57, 684, 210	65, 128, 692	10, 514, 230	8, 732, 884	19, 690, 490	15, 839, 868
1925	3, 079, 270	2, 794, 379	62, 823, 800	69, 986, 729	12, 849, 130	10, 521, 700	22, 860, 890	17, 344, 190
1926	4, 060, 280	4, 652, 717	66, 892, 530	75, 049, 930	15, 623, 030	12, 822, 084	23, 859, 390	18, 049, 012
1927	4, 618, 500	4, 716, 731	78, 544, 210	84, 177, 237	16, 404, 560	13, 297, 030	21, 666, 070	15, 985, 525
1928	3, 993, 190	3, 865, 895	74, 384, 490	81, 041, 349	16, 880, 870	13, 144, 910	23, 123, 870	16, 957, 264
1929	4, 212, 990	5, 030, 743	76, 174, 770	80, 685, 493	16, 546, 490	13, 702, 385	24, 393, 500	18, 034, 910
1930	4, 292, 030	4, 739, 122	74, 293, 090	77, 347, 379	12, 817, 800	10, 206, 975	17, 090, 710	12, 362, 159
1931	4, 222, 570	4, 276, 626	65, 811, 520	64, 908, 509	6, 812, 890	5, 496, 455	9, 727, 230	7, 193, 944
1932	3, 462, 290	2, 874, 179	48, 020, 560	43, 651, 774	3, 974, 540	3, 239, 991	3, 991, 160	2, 929, 116
1933	3, 254, 860	3, 486, 155	40, 857, 120	35, 843, 318	4, 633, 490	3, 175, 418	7, 984, 710	5, 512, 533
1934	6, 052, 970	5, 894, 259	55, 244, 470	52, 471, 430	5, 323, 450	3, 995, 177	9, 230, 880	6, 297, 579
1935	4, 919, 110	4, 494, 514	49, 487, 510	44, 888, 513	5, 267, 010	4, 011, 469	12, 191, 660	7, 902, 717
1936	11, 318, 880	8, 922, 761	79, 336, 740	76, 095, 094	7, 934, 080	6, 022, 693	17, 724, 880	11, 576, 156
1937	5, 388, 920	5, 850, 101	80, 271, 900	76, 972, 465	8, 160, 670	5, 852, 143	21, 331, 970	14, 704, 458
1938	6, 210, 520	6, 995, 418	88, 787, 080	84, 212, 446	5, 975, 970	4, 554, 775	9, 702, 860	6, 943, 429
1939	5, 811, 740	5, 851, 732	96, 894, 220	88, 988, 217	6, 996, 800	4, 970, 058	17, 287, 790	12, 632, 243
1940	5, 264, 100	5, 414, 038	92, 814, 090	86, 331, 273	7, 454, 300	5, 231, 815	22, 872, 050	15, 754, 692
1941	5, 152, 640	5, 226, 623	110, 192, 610	106, 985, 808	10, 771, 300	7, 536, 451	27, 436, 440	20, 069, 296
1942	8, 763, 980	9, 779, 249	107, 701, 010	105, 583, 801	17, 566, 640	10, 810, 977	30, 262, 910	24, 152, 113
1943	4, 950, 470	4, 834, 513	82, 412, 380	83, 397, 757	17, 235, 700	11, 346, 272	31, 570, 650	24, 505, 567

Year	Refractory		Agriculture		Other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1916	898, 518	$577, 109	1, 043, 876	$1, 109, 208	5, 615, 034	$2, 711, 480	87, 406, 678	$51, 442, 398
1917	1, 573, 573	1, 607, 743	1, 040, 248	1, 352, 397	5, 581, 380	3, 740, 967	80, 054, 499	56, 654, 202
1918	1, 825, 183	2, 363, 154	1, 091, 918	1, 626, 292	5, 222, 195	4, 571, 839	66, 573, 575	61, 948, 467
1919	1, 060, 741	1, 429, 775	1, 392, 914	2, 409, 460	3, 732, 513	4, 265, 455	62, 926, 484	65, 852, 137
1920	1, 735, 440	2, 393, 537	1, 364, 260	2, 724, 209	5, 033, 910	6, 622, 056	75, 800, 990	91, 654, 195
1921	496, 150	643, 638	1, 311, 520	2, 355, 339	3, 299, 950	5, 238, 391	60, 793, 050	71, 106, 998
1922	902, 170	1, 136, 236	1, 195, 000	2, 150, 435	4, 158, 540	6, 140, 771	76, 786, 030	79, 573, 582
1923	1, 151, 900	1, 572, 794	1, 278, 770	2, 160, 249	5, 654, 010	7, 629, 482	99, 195, 740	102, 657, 382
1924	1, 093, 940	1, 389, 413	1, 352, 600	2, 046, 860	5, 381, 660	7, 849, 004	98, 982, 260	104, 621, 160
1925	1, 261, 130	1, 548, 190	1, 954, 480	2, 880, 589	6, 240, 060	8, 674, 522	111, 068, 760	113, 750, 299
1926	1, 531, 070	1, 925, 832	1, 850, 620	3, 064, 235	6, 391, 910	8, 963, 250	120, 208, 830	124, 527, 060
1927	1, 362, 920	1, 710, 708	2, 206, 470	3, 360, 704	7, 090, 130	9, 730, 509	131, 892, 860	132, 978, 444
1928	1, 348, 160	1, 745, 066	2, 186, 870	3, 153, 848	7, 435, 820	9, 397, 372	129, 353, 270	129, 305, 704
1929	1, 558, 200	1, 807, 324	2, 654, 580	3, 764, 775	10, 923, 130	11, 135, 263	136, 463, 660	134, 160, 893
1930	1, 197, 500	1, 406, 776	2, 542, 100	3, 309, 329	10, 445, 740	9, 834, 469	122, 678, 970	119, 206, 209
1931	611, 070	633, 199	1, 421, 050	2, 117, 141	6, 570, 370	7, 496, 015	95, 176, 700	92, 121, 889
1932	197, 430	228, 559	910, 430	1, 230, 542	8, 267, 010	6, 531, 657	68, 823, 420	60, 685, 818
1933	501, 440	710, 526	994, 540	1, 239, 724	10, 688, 340	8, 793, 974	68, 914, 500	58, 761, 648
1934	677, 410	863, 078	1, 612, 380	1, 788, 142	12, 565, 060	10, 893, 382	90, 706, 620	82, 203, 047
1935	866, 320	1, 130, 232	2, 140, 370	2, 656, 728	6, 826, 170	7, 223, 241	81, 698, 150	72, 307, 414
1936	1, 324, 040	1, 831, 693	3, 907, 710	4, 512, 703	8, 061, 570	8, 799, 193	129, 607, 900	117, 760, 293
1937	1, 525, 260	2, 258, 900	5, 004, 930	6, 454, 695	9, 578, 360	9, 787, 829	131, 262, 010	121, 880, 591
1938	659, 690	991, 765	4, 367, 410	5, 637, 485	7, 369, 290	8, 141, 566	123, 072, 820	117, 476, 884
1939	1, 492, 310	2, 044, 054	5, 459, 260	6, 592, 827	11, 206, 650	11, 829, 358	145, 148, 770	132, 908, 489
1940	1, 740, 420	2, 329, 200	8, 724, 160	9, 910, 373	12, 757, 190	13, 655, 814	151, 626, 310	138, 627, 205
1941	2, 254, 120	3, 279, 104	11, 909, 640	14, 395, 831	13, 444, 230	16, 448, 479	181, 160, 980	173, 941, 592
1942	2, 718, 090	3, 999, 929	13, 745, 400	16, 993, 254	13, 779, 000	16, 981, 113	194, 537, 030	188, 300, 436
1943	2, 707, 860	4, 577, 047	14, 521, 670	19, 057, 120	17, 112, 800	23, 234, 403	170, 511, 530	170, 952, 679

COMMERCIAL AND NONCOMMERCIAL OPERATIONS

The following table shows the production of crushed stone for concrete and road metal during recent years by Government agencies of various kinds, contrasted with that by commercial enterprises. A striking change has occurred since 1939 in the ratio of commercial to noncommercial output. In that year 46 percent of total production was classed as noncommercial. It was applied largely to Government-sponsored make-work projects designed to combat unemployment. As war activities have solved the unemployment problem such projects are no longer necessary, and the noncommercial output dropped in 1943 to a mere 9 percent of the total.

Concrete and road metal sold or used by commercial and noncommercial operators in the United States, 1939–43

igures for "noncommercial operations" represent tonnages reported by States, counties, municipalities, and other Government agencies, produced either by themselves or by contractors expressly for their consumption, often with publicly owned equipment; they do not include purchases from commercial producers. Figures for "commercial operations" represent tonnages reported by all other producers]

Year	Commercial operations				Noncommercial operations				Total	
	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Percent of change in quantity from preceding year
939	52,519,470	$0.88	−3	54	44,374,750	$0.97	+29	46	96,894,220	+9
1940	55,748,940	.87	+6	60	37,065,150	1.02	−16	40	92,814,090	−4
1941	75,588,820	.94	+36	69	34,603,790	1.04	−7	31	110,192,610	+19
1942	92,251,930	.97	+22	86	15,449,080	1.05	−55	14	107,701,010	−2
1943	74,906,610	1.01	−19	91	7,505,770	1.05	−51	9	82,412,380	−23

GRANULES

The following table presents for the first time the production of roofing granules of all kinds.

Roofing granules sold or used in the United States, 1942–43, by kinds

Year	Natural		Artificially colored		Brick		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942	352,320	$2,650,503	538,310	$7,594,174	43,230	$636,961	933,860	$10,881,638
1943	287,090	2,190,143	543,870	7,745,452	47,650	716,685	878,610	10,652,280

SIZE OF PLANTS

The chapter on Stone covering 1942 included for the first time statistics of crushed-stone production according to size of plant. That analysis applied to 1941, and presented herein is a similar table for 1942. The most evident trend from 1941 to 1942 was the increase both in number of the larger plants and in the proportion of total output represented by them. This was to be expected because a considerable proportion of the output during 1942 was applied to war uses, such as airfields, fortifications, and military roads, including many large projects that tended to centralize aggregate demands in certain areas. On the other hand, the reduction in general market requirements was disadvantageous to many small- and moderate-size plants.

Number and production of commercial crushed-stone[1] plants in 1942, by sizes of output

Range of output	Number of plants	Total production of plants (short tons)	Percent of total	Cumulative total (short tons)
Less than 1,000 tons	126	62,620	0.04	62,620
1,000 to 25,000	769	7,562,960	4.54	7,625,580
25,000 to 50,000	228	8,238,490	4.94	15,864,070
50,000 to 75,000	123	7,520,850	4.51	23,384,920
75,000 to 100,000	80	7,053,010	4.23	30,437,930
100,000 to 200,000	178	24,643,640	14.78	55,081,570
200,000 to 300,000	74	17,923,330	10.75	73,004,900
300,000 to 400,000	44	14,662,800	8.79	87,667,700
400,000 to 500,000	28	12,306,650	7.38	99,974,350
500,000 to 600,000	15	8,372,460	5.02	108,346,810
600,000 to 700,000	6	4,019,040	2.41	112,365,850
700,000 to 800,000	9	6,720,620	4.03	119,086,470
800,000 to 900,000	6	5,193,970	3.12	124,280,440
900,000 tons and over	23	42,447,690	25.46	166,728,130
Total	1,709	166,728,130	100.00	166,728,130

[1] Exclusive of marble, which is primarily a dimension-stone industry.

METHODS OF TRANSPORTATION

The following table shows the quantities of concrete and road metal conveyed during 1942 and 1943 by each of the principal methods of transportation. The trend evident for several years toward the use of trucks for a larger and larger percent of the total was reversed in 1942 and 1943.

Concrete and road metal sold or used by commercial producers in the United States, 1942–43, by methods of transportation [1]

Method of transportation	1942		1943	
	Short tons	Percent of total	Short tons	Percent of total
Truck	50,830,270	55	41,457,070	55
Rail	27,932,080	30	22,248,420	30
Waterway	4,311,930	5	3,241,420	4
Unspecified	9,177,650	10	7,959,700	11
	92,251,930	100	74,906,610	100

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[1] For practical purposes the entire output of noncommercial operations commonly is moved by truck. Including noncommercial production, crushed stone for concrete and road metal moved as follows—1942: Truck 62 percent, rail 26 percent, water 4 percent, and unspecified 8 percent; 1943: Truck 59 percent, rail 27 percent, water 4 percent, and unspecified 10 percent.

GRANITE

Sales of crushed and broken granite declined 34 percent in quantity and 31 percent in value in 1943 compared with 1942. The greatest decline was in riprap. As very little harbor or shore-protection work was deemed essential to the war program in 1943, sales of riprap declined to only about one-eighth of their 1942 volume. Granite for concrete aggregate and road building declined 27 percent in quantity and 26 percent in value. The recession may be attributed to completion of many airfields, roads, and other structures essential to the military program. Railroad-ballast sales however gained 11 percent in quantity and 15 percent in value. The increase doubtless reflects the necessity of keeping the roadbeds of overworked railroads in adequate repair. The unit values at the quarry of concrete and road metal and railroad ballast increased 2 and 4 cents per ton, respectively.

The number of individual operations supplying noncommercial crushed stone cannot be determined with any degree of accuracy from the reports submitted. Therefore, in the accompanying tables covering granite and other kinds of crushed and broken stone, the number of active plants is not given. For many years before 1939, when noncommercial production was less important, such figures appeared in the tables.

Granite (crushed and broken stone) sold or used by producers in the United States in 1943, by States and uses

State	Riprap		Crushed stone				Other uses[1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	165,220	$218,998	1,012,990	$564,968	(2)	(2)	(2)	(2)	1,278,330	$841,066
Colorado			(2)	(2)					(2)	(2)
Connecticut	(2)	(2)					(2)	(2)	(2)	(2)
Delaware			(2)	(2)					(2)	(2)
Georgia	(2)	(2)	1,257,350	1,451,789	(2)	(2)	(2)	(2)	1,680,270	2,002,399
Maine	2,220	1,731	4,900	10,736					7,120	12,467
Maryland	37,380	96,418	36,670	68,077	7,000	$8,000			81,050	172,495
Massachusetts	(2)	(2)	304,450	371,899			(2)	(2)	330,140	401,950
Minnesota	(2)	(2)	(2)	(2)	(2)	(2)	4,810	$21,685	54,300	68,533
Missouri	(2)	(2)							(2)	(2)
Montana	(2)	(2)	(2)	(2)					(2)	(2)
New Hampshire	380	514	68,250	95,230			50	25	68,680	95,769
New Jersey			(2)	(2)					(2)	(2)
New Mexico			(2)	(2)					(2)	(2)
New York	2,720	5,537	161,790	235,477	23,480	34,040	30,560	9,168	218,550	284,222
North Carolina	(2)	(2)	1,664,160	1,882,311	458,660	477,403	(2)	(2)	2,161,090	2,530,704
Oklahoma	(2)	(2)	(2)	(2)					(2)	(2)
Oregon			(2)	(2)					(2)	(2)
Pennsylvania	4,970	5,552	403,210	553,099					408,180	558,651
Puerto Rico			(2)	(2)					(2)	(2)
Rhode Island	4,000	4,000	32,370	48,533			4,430	5,321	40,800	57,854
South Carolina	7,970	8,757	939,210	1,143,531	514,240	497,254	41,670	11,732	1,503,090	1,661,274
Vermont			(2)	(2)					(2)	(2)
Virginia	(2)	(2)	744,760	939,042	(2)	(2)	(2)	(2)	863,770	1,056,059
Washington	(2)	(2)					(2)	(2)	17,190	114,933
Wisconsin	(2)	(2)	65,200	53,962			(2)	(2)	69,370	56,319
Wyoming	(2)	(2)							(2)	(2)
Undistributed	89,880	95,424	157,010	293,219	357,740	273,301	346,700	738,877	174,470	310,915
	314,740	436,931	6,852,320	7,711,873	1,361,120	1,289,998	428,220	786,808	8,956,400	10,225,610
Average unit value		$1.39		$1.13		$0.95		$1.84		$1.14

[1] Includes stone used for poultry grit and stone sand.

[2] Included under "Undistributed."

BASALT AND RELATED ROCKS (TRAP ROCK)

The dark igneous rocks—basalt, gabbro, and diorite—known commercially as trap rock, are used widely for highway construction and concrete aggregate. Sales of crushed and broken trap rock were 19 percent less and the value was 16 percent less in 1943 than in 1942. The value per ton increased from $1.19 to $1.23. Sales of riprap declined 9 percent in quantity and 19 percent in value, and the average return per ton decreased from $1.11 to 99 cents. Sales of trap rock for concrete aggregate and road construction declined 24 percent in quantity and 19 percent in value, although the value per ton increased from $1.18 to $1.25. For the same reason as mentioned in the preceding section on granite, sales of railroad ballast increased 17 percent in quantity and 27 percent in value. The value per ton increased from 91 cents to $1.

Basalt and related rocks (trap rock) (crushed and broken stone) sold or used by producers in the United States in 1943, by States and uses

State	Riprap		Crushed stone				Other uses[1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	345, 670	$399, 436	1, 105, 940	$1, 147, 036	1, 210	$1, 317	12, 290	$5, 336	1, 465, 110	$1, 553, 125
Colorado	(2)	(2)	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Connecticut	21, 270	23, 300	969, 140	1, 048, 782	91, 410	82, 273	----------	----------	1, 081, 820	1, 154, 355
Hawaii	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Idaho	(2)	(2)	(2)	(2)	----------	----------	----------	----------	87, 510	119, 614
Maine	----------	----------	16, 740	25, 576	----------	----------	----------	----------	16, 740	25, 576
Maryland	----------	----------	(2)	(2)	(2)	(2)	----------	----------	478, 280	608, 071
Massachusetts	19, 900	16, 350	456, 910	499, 747	279, 120	280, 394	35, 000	78, 750	790, 930	875, 241
Michigan	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Minnesota	----------	----------	(2)	(2)	(2)	(2)	----------	----------	(2)	(2)
Montana	(2)	(2)	----------	----------	----------	----------	----------	----------	(2)	(2)
New Jersey	(2)	(2)	2, 005, 370	2, 362, 724	66, 970	71, 522	(2)	(2)	2, 199, 070	2, 596, 537
New York	6, 670	2, 666	866, 450	1, 029, 667	290, 140	368, 295	----------	----------	1, 163, 260	1, 400, 628
North Carolina	----------	----------	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Oregon	133, 680	91, 333	1, 212, 310	1, 487, 411	32, 720	22, 771	----------	----------	1, 378, 710	1, 601, 515
Pennsylvania	----------	----------	1, 109, 980	1, 312, 478	265, 050	230, 822	4, 000	6, 000	1, 379, 030	1, 549, 300
Puerto Rico	----------	----------	(2)	(2)	(2)	(2)	----------	----------	(2)	(2)
Rhode Island	(2)	(2)	(2)	(2)	----------	----------	----------	----------	(2)	(2)
Texas	----------	----------	(2)	(2)	(2)	(2)	----------	----------	(2)	(2)
Virginia	(2)	(2)	192, 630	253, 925	(2)	(2)	----------	----------	196, 900	263, 814
Washington	222, 270	180, 570	1, 153, 920	1, 376, 215	367, 600	332, 664	2, 820	507	1, 746, 610	1, 889, 956
Wisconsin	----------	----------	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Wyoming	(2)	(2)	----------	----------	----------	----------	----------	----------	(2)	(2)
Undistributed	137, 290	159, 819	2, 256, 270	3, 682, 153	375, 640	376, 959	203, 550	624, 336	2, 275, 960	3, 943, 402
	886, 750	873, 474	11, 345, 668	14, 225, 714	1, 769, 860	1, 767, 017	257, 660	714, 929	14, 259, 930	17, 581, 134
Average unit value	----------	$0. 99	----------	$1. 25	----------	$1. 00	----------	$2. 77	----------	$1. 23

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[1] Includes stone sold for base course, fill material, roofing granules, and unspecified uses.

[2] Included under "Undistributed."

MARBLE

Large quantities of waste accumulate at marble quarries and finishing mills. Most of it is virtually pure calcium carbonate that is interchangeable with high-grade limestone for all the uses of the latter product. Producers of building and monumental marble are able therefore to find outlets for their waste stone in the form of crushed and pulverized products. As the following table indicates, the price per ton realized varies greatly, because some States produce relatively high priced products, such as terrazzo, stucco, and marble flour, that may sell for several dollars a ton, whereas other States find outlets only in the form of riprap, roadstone, and concrete aggregate that may command prices of only $1 or less per ton.

Marble (crushed and broken stone) sold by producers in the United States in 1943, by States [1]

State	Active plants	Short tons	Value	State	Active plants	Short tons	Value
Alabama	2	(2)	(2)	Utah	1	6,140	$66,459
California	1	1,060	$7,500	Virginia	1	240	2,003
Georgia	1	14,000	14,550	Washington	1	170	660
Maryland	1	(2)	(2)	Undistributed		56,780	236,535
Missouri	2	3,350	16,560				
New York	1	20,410	133,805		15	125,400	530,543
Tennessee	3	23,250	52,471	Average unit value			$4.23
Texas	1	(2)	(2)				

[1] Includes agriculture, artificial stone, crushed stone, mineral food, poultry grit, riprap, spalls, stucco, terrazzo, tile, and whiting (excluding marble whiting made by companies that purchase their marble).

[2] Included under "Undistributed."

LIMESTONE

Limestone sales were reported to the Bureau of Mines from 45 States in 1943. Because limestone is of wide occurrence, in many areas it is the most convenient kind of stone for highway or building construction and railroad ballast. The over-all cost of quarrying and crushing this stone is generally lower than that of the harder rocks. Limestone is an essential raw material for many metallurgical, chemical, and processing industries for which no other kinds of stone can be substituted. As a result of these various favorable conditions, it is by far the most widely used type of stone in the United States. In 1943 limestone constituted 76 percent of all crushed and broken stone sold (excluding that used for making cement and lime).

Sales in 1943 were 9 percent lower in quantity and 7 percent lower in value than in 1942. Riprap sales made moderate gains, but the value per ton declined from $1.09 to 97 cents. Fluxing-stone sales gained 4 percent to reach an all-time high. The low level of highway building and private construction in 1943 was reflected in a drop of 24 percent in quantity and 23 percent in value of limestone sold for concrete and road metal uses. Railroad-ballast sales declined moderately, but high farm income and the urgent call for increased farm crops stimulated a 6-percent gain in sales of agricultural limestone. Sales for uses other than the five major applications already mentioned are itemized in a following table.

Limestone (crushed and broken stone) sold or used by producers in the United States in 1943, by States and uses

State	Riprap		Fluxing stone		Crushed stone				Agriculture		Other		Tota	
					Concrete and road metal		Railroad ballast							
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	1, 860, 740	$1, 657, 577	212, 880	$216, 217	(1)	(1)	198, 670	$234, 949	188, 650	$683, 420	2, 469, 850	$2, 797, 500
Alaska					(1)	(1)							(1)	(1)
Arizona			40, 470	26, 781	23, 890	34, 609							64, 360	61, 390
Arkansas	3, 930	$4, 373	510	512	610, 460	583, 584	43, 900	$46, 797	54, 560	91, 382	43, 010	118, 193	756, 370	844, 841
California			41, 860	77, 926	270, 720	251, 873	(1)	(1)	(1)	(1)	367, 070	855, 318	680, 650	1, 186, 733
Colorado			436, 650	205, 560					680	957	168, 150	189, 256	605, 480	395, 773
Connecticut			(1)	(1)	(1)	(1)			41, 680	118, 653	(1)	(1)	100, 330	191, 782
Florida					6, 453, 000	5, 581, 768	244, 500	115, 713	56, 270	162, 987	1, 987, 430	1, 585, 920	8, 741, 200	7, 446, 388
Georgia			3, 910	8, 219	199, 650	247, 683			85, 100	230, 200	103, 500	289, 102	392, 160	775, 204
Hawaii											(1)	(1)	(1)	(1)
Idaho											(1)	(1)	(1)	(1)
Illinois	71, 660	88, 623	688, 280	673, 167	6, 119, 780	5, 502, 333	743, 750	559, 139	3, 007, 320	3, 024, 575	473, 770	881, 762	11, 104, 560	10, 729, 599
Indiana	35, 320	33, 197	5, 610	5, 236	3, 753, 530	3, 610, 730	348, 630	273, 790	1, 059, 720	1, 059, 279	111, 630	171, 077	5, 314, 440	5, 153, 309
Iowa	106, 610	140, 855	21, 220	22, 165	2, 022, 820	2, 194, 317	84, 760	47, 998	1, 264, 760	1, 646, 347	43, 680	275, 049	3, 543, 850	4, 326, 731
Kansas	42, 560	58, 673	360	550	993, 200	1, 202, 528	419, 850	435, 042	165, 450	182, 403	9, 110	66, 028	1, 630, 530	1, 945, 224
Kentucky	411, 730	239, 911			2, 782, 710	2, 825, 893	565, 000	379, 358	857, 940	859, 799	1, 670	1, 656	4, 619, 060	4, 306, 617
Louisiana					(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)
Maine			61, 030	90, 244	590	1, 773			15, 730	51, 208	27, 050	47, 344	104, 400	190, 569
Maryland	(1)	(1)	(1)	(1)	669, 990	786, 270	(1)	(1)	22, 660	66, 890	64, 150	202, 938	818, 240	1, 142, 677
Massachusetts			21, 660	32, 609					123, 210	367, 468	32, 120	116, 702	176, 990	516, 779
Michigan	47, 720	53, 450	9, 657, 100	4, 781, 674	1, 288, 720	879, 826	122, 330	96, 769	312, 950	298, 043	4, 438, 150	3, 417, 713	15, 866, 970	9, 527, 475
Minnesota	(1)	(1)	(1)	(1)	331, 210	335, 597	(1)	(1)	179, 290	257, 147	31, 910	83, 098	581, 910	719, 431
Mississippi					(1)	(1)							(1)	(1)
Missouri	209, 220	254, 171	11, 190	16, 301	2, 581, 270	2, 953, 570	305, 460	245, 060	895, 970	1, 131, 848	276, 640	780, 283	4, 279, 750	5, 381, 233
Montana	(1)	(1)	114, 770	106, 622	(1)	(1)	(1)	(1)			26, 960	42, 141	175, 230	176, 897
Nebraska	(1)	(1)			159, 340	179, 483	(1)	(1)	(1)	(1)	87, 530	455, 438	538, 380	968, 932
Nevada			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)
New Jersey			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)
New Mexico	(1)	(1)			(1)	(1)	(1)	(1)					421, 590	228, 432
New York	292, 580	366, 627	118, 500	109, 284	3, 581, 800	3, 720, 371	844, 040	576, 829	309, 440	922, 322	1, 717, 140	848, 647	6, 863, 500	6, 544, 080
North Carolina	50, 600	81, 181			91, 920	122, 573	3, 960	5, 934	13, 960	16, 823	1, 080	1, 296	161, 520	227, 807
Ohio	37, 540	36, 572	5, 953, 080	4, 594, 174	5, 782, 260	5, 130, 238	1, 109, 580	873, 314	1, 685, 330	2, 004, 706	1, 043, 130	1, 265, 023	15, 610, 920	13, 904, 027
Oklahoma	414, 580	422, 101	191, 350	169, 180	1, 199, 710	1, 071, 297	437, 540	263, 695	30, 380	35, 004	73, 710	86, 953	2, 347, 270	2, 048, 230
Oregon							(1)	(1)	(1)	(1)	24, 450	52, 162	36, 780	74, 182
Pennsylvania	65, 110	75, 008	10, 025, 610	9, 761, 870	4, 173, 340	4, 327, 514	400, 180	414, 362	882, 760	2, 239, 829	1, 088, 350	1, 855, 203	16, 635, 350	18, 673, 786
Puerto Rico					(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Rhode Island			(1)	(1)	(1)	(1)			(1)	(1)			(1)	(1)
South Carolina					42, 600	53, 494			70, 040	89, 428			112, 640	142, 922

See footnote at end of table.

Limestone (crushed and broken stone) *sold or used by producers in the United States in 1943, by States and uses*—Continued

State	Riprap		Fixing stone		Crushed stone				Agriculture		Other		Total	
					Concrete and road metal		Railroad ballast							
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
South Dakota	(1)	(1)	----------	----------	72, 530	106, 963	----------	----------	----------	----------	(1)	(1)	77, 530	115, 421
Tennessee	684, 490	522, 267	47, 170	51, 047	5, 598, 140	6, 738, 105	720, 130	530, 845	982, 430	1, 106, 175	207, 710	343, 434	8, 240, 070	9, 291, 873
Texas	30, 360	26, 443	(1)	(1)	1, 222, 750	1, 283, 182	615, 030	365, 484	(1)	(1)	447, 850	490, 648	2, 382, 130	2, 217, 680
Utah	(1)	(1)	216, 740	151, 550	35, 460	51, 011	(1)	(1)	----------	----------	28, 260	87, 705	379, 610	332, 240
Vermont	----------	----------	(1)	(1)	(1)	(1)	----------	----------	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	14, 040	20, 525	473, 110	502, 318	1, 639, 870	1, 645, 761	612, 760	512, 887	896, 520	918, 347	726, 270	694, 669	4, 362, 570	4, 294, 507
Washington	----------	----------	7, 560	5, 892	----------	----------	----------	----------	17, 610	77, 318	267, 150	388, 769	292, 320	471, 979
West Virginia	680	500	1, 447, 110	1, 294, 152	534, 740	615, 796	500, 110	463, 120	122, 250	203, 924	351, 250	437, 485	2, 956, 140	3, 014, 977
Wisconsin	107, 490	127, 849	16, 170	13, 689	2, 302, 210	1, 949, 753	118, 570	80, 749	999, 150	1, 255, 778	81, 010	65, 169	3, 624, 600	3, 492, 987
Wyoming	30, 570	22, 397	(1)	(1)	(1)	(1)	(1)	(1)	----------	----------	75, 060	119, 699	241, 250	190, 017
Undistributed	129, 990	124, 584	108, 890	147, 268	386, 510	514, 913	940, 980	648, 529	169, 840	403, 331	930, 830	1, 583, 291	1, 432, 700	2, 448, 793
	2, 786, 780	2, 699, 307	31, 570, 650	24, 505, 567	55, 137, 600	54, 719, 025	9, 181, 060	6, 935, 414	14, 521, 670	19, 057, 120	15, 545, 430	18, 582, 591	128, 743, 190	126, 499, 024
Average unit value	----------	$0. 97	----------	$0. 78	----------	$0. 99	----------	$0. 76	----------	$1. 31	----------	$1. 20	----------	$0. 98

[1] Included under "Undistributed."

Limestone (crushed and broken stone) sold or used by producers in the United States for miscellaneous uses, 1942–43

Use	1942		1943	
	Short tons	Value	Short tons	Value
Alkali works	6,350,450	$3,005,483	6,867,190	$4,189,940
Calcium carbide works	430.600	399,169	526,920	538,425
Coal-mine dusting	193,260	491,819	194,360	497,258
Filler (not whiting substitute):				
Asphalt	439,430	1,026,138	440,510	887,908
Fertilizer	226,910	407,301	276,410	405,334
Other	107,760	379,948	178,250	570,664
Filter beds	66,310	111,417	36,260	74,586
Glass factories	434,080	656,775	504,930	811,991
Limestone sand	484,810	369,408	428,010	387,896
Limestone whiting [1]	326,930	2,277,835	296,370	2,068,098
Magnesium metal (dolomite)	(2)	(2)	887,830	891,350
Magnesia works (dolomite)	117,650	151,756	[3] 203,240	[3] 242,974
Mineral food	169,880	792,949	293,490	1,394,705
Mineral (rock) wool	119,620	106,985	89,590	101,832
Paper mills	435,200	760,332	384,960	699,266
Poultry grit	62,620	371,221	119,080	700,163
Refractory (dolomite)	1,354,090	1,197,386	1,105,560	1,120,258
Road base	931,680	740,557	1.984,460	1.544,409
Stucco, terrazzo, and artificial stone	17,890	123,643	21,270	129,522
Sugar factories	625,520	986,210	347,320	658,209
Other uses [4]	213,980	317,478	292,790	480,927
Use unspecified	91,230	245,279	66,630	186,876
	13,199,900	14,919,089	15,545,430	18,582,591

[1] Includes stone for filler for calcimine, chewing gum, explosives, leather goods, linoleum, paint, paper, phonograph records, plastics, pottery, putty, roofing, rubber, and unspecified uses.

[2] Figures not available.

[3] Includes refractory magnesia.

[4] Includes stone for acid neutralization, brick glazing, carbon dioxide, ceramics, chemicals (unspecified), concrete blocks and pipes, dye, electric products, motion-picture snow, oil-well drilling, rayon, rice milling, spalls, spray, sulfuric acid, and water treatment.

Dolomite (calcium-magnesium carbonate), which occurs extensively in the United States, is attaining increasing commercial importance. Dead-burned dolomite is used as a refractory lining for metallurgical furnaces, and statistical data for this product (which is closely allied to lime) are given in the Lime chapter of this volume. Dolomite is sold for refractory use, also in the raw state, particularly for patching. Dolomite is used in considerable quantities as a source of magnesia (MgO), which may be applied to refractory use or may be employed in various other ways. In 1943, for the first time, dolomite was used extensively as an ore of magnesium metal. As indicated in the accompanying table, 887,830 tons were so employed in the United States. As dolomite has attained so great importance because of its magnesium content, the Bureau of Mines has compiled a comprehensive report[3] describing and discussing the economic features of all the known methods of separating magnesia from it.

Sales of dolomite and its primary product of calcination—dolomitic lime—for certain special uses are covered in the following table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1942–43

	1942	1943
Dolomite for—		
Basic magnesium carbonate:		
Short tons	117,650	[1] 203,240
Value	$151,756	[1] $242,974
Magnesium metal:		
Short tons	(2)	887,830
Value	(2)	$891,350
Refractory uses:		
Short tons	1,354,090	1,105,560
Value	$1,197,386	$1,120,258

See footnotes at end of table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1942–43—Continued

	1942	1943
Dolomitic lime for—		
Refractory (dead-burned dolomite):		
Short tons	1, 229, 357	1, 276, 725
Value	$10, 817, 634	$11, 243, 017
Paper mills:		
Short tons	85, 000	72, 000
Value	$604, 000	$524, 000
Total (calculated as raw stone) short tons	4, 100, 000	4, 900, 000

[1] Includes refractory magnesia.
[2] Figures not available.

Fluxing limestone has attained such importance that the Bureau of Mines has separated the figures by principal uses, as indicated in the accompanying table.

Sales of fluxing limestone, 1939–43, by uses

Year	Blast furnaces		Open-hearth plants		Other smelters [1]		Other metallurgical [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	13, 115, 580	$9, 505, 807	3, 471, 570	$2, 638, 935	522, 330	$331, 969	162, 080	$142, 227	17, 271, 560	$12,618,938
1940	15, 611, 720	10, 638, 341	6, 500, 680	4, 462, 852	342, 240	278, 726	402, 270	358, 968	22, 856, 910	15, 738, 887
1941	20, 244, 510	14, 832, 938	6, 332, 210	4, 469, 838	481, 100	398, 839	374, 700	362, 544	27, 432, 520	20, 064, 159
1942	23, 663, 630	18, 523, 158	5, 843, 820	4, 886, 157	494, 720	460, 270	257, 080	277, 728	30, 259, 250	24, 147, 313
1943	24, 755, 920	18, 785, 578	5, 932, 900	4, 899, 369	671, 990	581, 325	209, 840	239, 295	31, 570, 650	24, 505, 567

[1] Includes flux for copper, gold, lead, zinc, and unspecified smelters.
[2] Includes flux for foundries, and for cupola and electric furnaces.

Limestone is quarried not only for use raw but also for manufacture into cement and lime. The large and important industries manufacturing these products are covered in separate chapters of Minerals Yearbook. It is of interest, however, to show in one table, as follows, the total tonnage of limestone consumed for all purposes.

Limestone sold or used for all purposes in the United States, 1941–43, in short tons

Use	1941	1942	1943
Limestone (as given in this report) (approximate)	133, 164, 000	142, 488, 000	128, 980, 000
Portland cement (including "cement rock") [1] Natural cement ("cement rock") [1]	42, 735, 000	47, 657, 000	35, 867, 000
Lime [2]	12, 159, 000	12, 208, 000	13, 193, 000
	188, 058, 000	202, 353, 000	178, 040, 000

[1] Reported in terms of cement in chapter on Cement.
[2] Reported in terms of lime in chapter on Lime.

SANDSTONE

Sales of crushed and broken sandstone were 13 percent higher in quantity and 39 percent higher in value in 1942 than in 1943. Ganister production exceeded the previous all-time high of 1942 by a wide margin. The notable increase in sales of sandstone applied to miscellaneous uses is due in part to more complete coverage of stone granules, and the marked increase in average value per ton from 85 cents to $2.37 resulted from evaluation of granules upon a crushed and screened basis rather than upon the crude lump-rock basis used heretofore.

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[3] Schallis, Alvin, Economic Considerations in the Recovery of Magnesia from Dolomite: Bureau of Mines Inf. Circ. 7247, 1943, 53 pp.

Sandstone (crushed and broken stone) sold or used by producers in the United States in 1943, by States and uses

State	Refractory stone (ganister)		Riprap		Crushed stone				Other uses[1]		Total	
					Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(2)	(2)									(2)	(2)
Arizona			(2)	(2)							(2)	(2)
Arkansas			(2)	(2)	(2)	(2)					(2)	(2)
California	17,610	$87,781	(2)	(2)	1,044,820	$674,969	(2)	(2)	(2)	(2)	1,394,550	$907,263
Colorado	22,980	35,194	1,300	$1,300							24,280	36,494
Illinois	(2)	(2)									(2)	(2)
Kansas			101,260	104,254	113,090	145,801	22,380	$20,460			236,730	270,515
Massachusetts					(2)	(2)					(2)	(2)
Michigan					(2)	(2)					(2)	(2)
Minnesota			2,030	2,841							2,030	2.841
Missouri			(2)	(2)	(2)	(2)					(2)	(2)
Montana			(2)	(2)							(2)	(2)
New York	(2)	(2)	540	1,053	47,900	62,073			(2)	(2)	157,040	273,880
North Carolina					(2)	(2)			(2)	(2)	(2)	(2)
Ohio	167,570	739,479	(2)	(2)					(2)	(2)	256,710	1,271,105
Oklahoma			(2)	(2)	(2)	(2)					(2)	(2)
Oregon			(2)	(2)							(2)	(2)
Pennsylvania	752,720	1,455,518	3.640	6.194	374,320	457,717	220,420	238,830	2,100	$6,300	1,353,200	2,164,559
South Dakota	(2)	(2)	(2)	(2)	106,070	151,213			24,520	36,748	170,640	267,190
Texas			(2)	(2)							(2)	(2)
Utah	4,580	13,206									4,580	13,206
Vermont					(2)	(2)					(2)	(2)
Virginia	(2)	(2)	(2)	(2)	49,030	61,314	(2)	(2)	(2)	(2)	190,510	210,781
West Virginia	(2)	(2)	(2)	(2)	(2)	(2)					188,250	279,629
Wisconsin	(2)	(2)			(2)	(2)			(2)	(2)	453,290	2,129,183
Wyoming			(2)	(2)							(2)	(2)
Undistributed	615,700	987,209	374,690	228,296	1,790,670	1,515,205	42.540	28,367	1,404,370	3,342,461	2,875,040	2,577,137
	1,581,160	3,318,387	483,460	343,938	3,525,900	3,068,292	285,340	287,657	1,430,990	3,385,509	7,306,850	10,403,783
Average unit value		$2.10		$0.71		$0.87		$1.01		$2.37		$1.42

[1] Includes sanstone for chemical use, fill material, filter stone, poultry grit, rock wool, roofing granules, and stone sand.

[2] Included under "Undistributed."

MISCELLANEOUS STONE

Crushed and broken stone, other than the five principal varieties already discussed, includes light-color volcanic rocks, schists, boulders from river beds, serpentine, and flint. The following table shows sales of stone of these types, by States and uses, in 1943; such sales declined 25 percent in quantity and 30 percent in value compared with 1942.

Miscellaneous varieties of stone (crushed and broken stone) sold or used by producers in the United States in 1943, by States and uses

State	Riprap		Crushed stone				Other uses [1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			(2)	(2)					(2)	(2)
Alaska			(2)	(2)					(2)	(2)
Arizona			(2)	(2)					(2)	(2)
Arkansas	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)
California	381,070	$385,566	2,694,810	$1,454,705	(2)	(2)	(2)	(2)	3,396,450	$1,940,664
Colorado			(2)	(2)	(2)	(2)			(2)	(2)
Florida			(2)	(2)			(2)	(2)	(2)	(2)
Georgia			(2)	(2)					(2)	(2)
Illinois			(2)	(2)					(2)	(2)
Kansas [3]			120,860	42,299	76,510	$14,144			197,370	56,443
Maine			(2)	(2)			(2)	(2)	61,570	121,688
Maryland	(2)	(2)	(2)	(2)			(2)	(2)	6,290	10,073
Massachusetts			59,360	73,920					59,360	73,920
Michigan			(2)	(2)			(2)	(2)	(2)	(2)
Missouri [3]			[4] 496,420	[4] 169,587	835,100	116,412			[4] 1,331,520	[4] 285,999
Montana			(2)	(2)					(2)	(2)
Nevada			(2)	(2)	(2)	(2)			(2)	(2)
New Hampshire							1,090	$9,269	1,090	9,269
New Jersey			(2)	(2)			(2)	(2)	(2)	(2)
New York			(2)	(2)	(2)	(2)			(2)	(2)
North Carolina			(2)	(2)					(2)	(2)
Ohio			(2)	(2)					(2)	(2)
Oklahoma [3]			751,980	263,193	2,976,870	368,593			3,728,850	631,786
Oregon			94,530	126,754					94,530	126,754
Pennsylvania	130	162	115,740	155,860			39,790	197,922	155,660	353,944
Puerto Rico			(2)	(2)					(2)	(2)
Rhode Island			(2)	(2)					(2)	(2)
South Dakota			(2)	(2)					(2)	(2)
Tennessee			(2)	(2)					(2)	(2)
Texas	(2)	(2)	(2)	(2)	(2)	(2)			(2)	(2)
Virginia	(2)	(2)	(2)	(2)			(2)	(2)	36,470	114,160
Washington	(2)	(2)	(2)	(2)			(2)	(2)	24,960	11,249
Wisconsin			7,660	4,600					7,660	4,600
Undistributed	97,540	95,135	1,209,540	1,381,935	749,840	567,037	410,920	285,492	2,017,980	1,972,036
	478,740	480,863	5,550,900	3,672,853	4,638,320	1,066,186	451,800	492,683	11,119,760	5,712,585
Average unit value		$1.00		$0.66		$0.23		$1.09		$0.51

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[1] Includes stone used for ballast for ships, filler (unspecified), ornamental concrete, poultry grit, refractory, road base, rock wool, roofing granules, spalls, and waste.

[2] Included under "Undistributed."

[3] Chats; figures collected by Joplin (Mo.) office of the Bureau of Mines.

[4] A small quantity of stone included with chats.

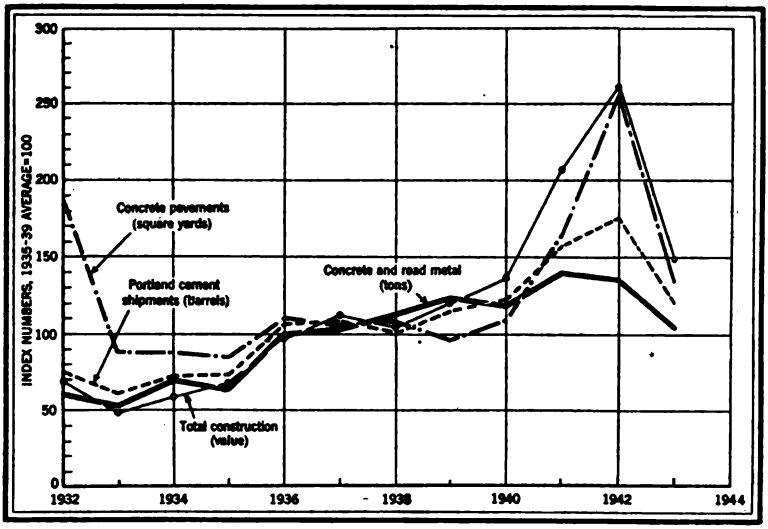

FIGURE 3.—Crushed-stone aggregates (concrete and road metal) sold or used in the United States compared with shipments of portland cement, total construction (value), and concrete pavements (contract awards, thousands of square yards), 1932–43. Data on construction and concrete pavements from Bureau of Foreign and Domestic Commerce.

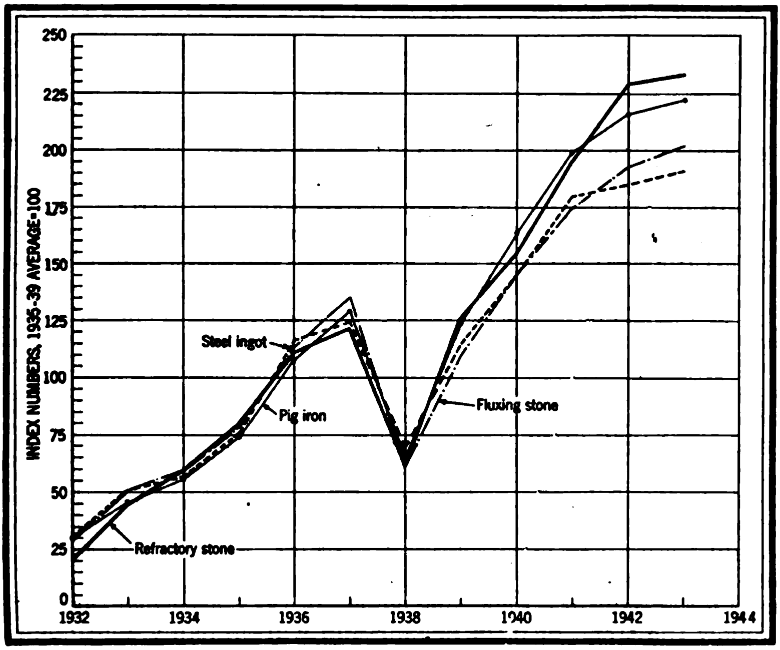

FIGURE 4.—Sales (tons) of fluxing stone and refractory stone, including that used in making lime, as recorded in the chapter on Lime compared with production of steel ingot and pig iron, 1932–43. Statistics of steel-ingot production compiled by American Iron and Steel Institute.

MARKETS

Crushed stone is used extensively as an aggregate in concrete for both highway and building construction. Sales should therefore normally follow the trends of cement shipments and area of concrete pavements that are constructed. These relationships are indicated in figure 3. Concrete pavements, the largest item of which was airfield runways, declined very greatly because most of such facilities were nearing completion by the end of the year. As total building-construction value declined more than 40 percent from the 1942 level, it is not surprising that both cement shipments and aggregates should decrease decisively.

The drastic downward trend in construction in 1943 found no counterpart in the metallurgical industries. Pig-iron production, which reached nearly 61 million tons, surpassed all previous records; therefore the demands for limestone furnace flux were the highest in the history of the stone industry. Steel-ingot production of nearly 89 million tons was also the highest on record. To replace burned-out furnace linings and to keep them in repair placed a heavy burden on producers of dolomite for refractory use and of ganister for making silica brick. The relations of fluxing-stone output to pig-iron production and of refractory stone to steel-ingot manufacture over a 12-year period are indicated in figure 4.

POST-WAR PROSPECTS

The principal uses for crushed stone are as aggregates in building construction and highways. The cumulative shortage of homes in the United States, according to some estimates, will demand new construction at a rate of a million residential units annually for 10 years after the war. A further accumulated need is in evidence for public and commercial buildings. Work on highway construction and repair, except for military roads, has been substantially reduced during the war period, and an insistent call for more and better highways is to be expected when travel restrictions are relaxed. Already plans, although somewhat nebulous, are taking shape for the construction of great superhighways that will bypass the maze of intersections that now impedes travel in intermediate cities. Prospective construction of many kinds furnishes reasonable assurance of a continuing moderate to strong demand for crushed-stone aggregates. National leaders are devoting much earnest thought to the avoidance of a great depression when peace comes, and no field offers greater promise of post-war employment than construction in its broadest sense. The aggregate industries will take a prominent part in any great building program.

A speedy transition from the current enormous output of munitions to construction and to the manufacture of civilian goods will afford reasonable assurance of substantial markets for flux and refractory stone and for that used in the chemical and processing industries. The demand for agricultural limestone which, in 1943, exceeded the supply, will follow the trend of farm income and will probably continue at a high level in the post-war era so long as food supplies must be augmented to feed a starving world. There is reasonable prospect therefore that all major branches of the crushed-stone industry may expect substantial market demands in the era after the war if plans for transition to a satisfactory peacetime economy materialize with reasonable success.

FOREIGN TRADE

As publication of foreign trade figures is still restricted for military reasons, no statistics of imports or exports can be given. They will, however, be published at the termination of the present war emergency to preserve the continuity of the statistical record.

Foreign trade in stone is relatively small. As indicated in the discussion presented in Minerals Yearbook, 1942, imports and exports of stone amount to only a fraction of 1 percent of average domestic sales. Therefore, their omission will not detract appreciably from the value of this report.

SLATE

By Oliver Bowles and M. S. Jensen

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SUMMARY

Slate production (which declined 5 percent in quantity and 15 percent in value in 1942 compared with 1941) decreased again in 1943. From the low level of 1942 it fell 21 percent in quantity and 23 percent in value. Except for granules used in composition roofing for various more or less temporary types of military construction, slate finds very limited application in the military program; and, as building construction fell to a very low level during 1943, use of dimension slate was confined primarily to repair and replacement work.

Roofing-slate sales fell 50 percent in quantity and 51 percent in value and reached the lowest point in the recorded history of the industry—less than one-tenth of the volume of sales 35 years ago. The average value per square in 1943 was $8.75, whereas in 1942 it was $8.87. In the Pennsylvania area sales were 39 percent lower in both quantity and value than in 1942. In the New York-Vermont area sales slumped to very low levels. Virginia sales dropped 43 percent in quantity and 38 percent in value.

Sales of mill stock decreased 18 percent in quantity and 16 percent in value. Sales of electrical slate, which had made decided gains during recent years, were 21 percent less in quantity and 17 percent in value; this doubtless reflects a recession in the establishment of new electrical facilities. As total new construction dropped from 261 percent of the 1935–39 average in 1942 to 149 percent in 1943, it is not surprising that sales of structural and sanitary slate dropped 39 percent in quantity and 36 percent in value. Military construction and war housing, which dominated the 1943 building program, use much smaller quantities of slate than normal peacetime building having the same dollar value. A decline of 42 and 43 percent in quantity and value, respectively, of blackboards and bulletin boards sold reflects the low level of new construction of educational institutions.

Sales of vaults and covers increased 50 percent in quantity and 55 percent in value. The remarkable gain of 100 percent in quantity and 111 percent in value of billiard-table tops reverses the trend of a year ago and indicates an increasing demand for recreational facilities, possibly because more spending money is available than heretofore.

Sales of school slates, most of which are exported, declined 18 percent in quantity and 9 percent in value. Sales of flagstones, stepping stones, and similar products decreased 19 percent in quantity but gained 19 percent in value.

Statistics on slate granules and flour are included in this chapter, although these products have little connection with the dimension-slate industry, except that granules are used in roofing products that compete in the roofing-slate market. For the most part, slate used for the manufacture of granules is unsuitable for other slate products. Sales of granules and flour declined 18 percent in quantity and 14 percent in value in 1943 compared with 1942. This was to be expected because the more or less temporary types of warehouse and barracks construction, as well as war housing that used large quantities of granule-surfaced roofing, had passed their peak in 1943. In that year the average sales value of granules f. o. b. mill was $8.71 and of flour $3.65 per short ton, compared with $8.29 and $3.53, respectively, in 1942. Figures for sales of granules made of rock other than slate are given in the chapter of this volume on Stone.

The following table presents the principal statistical data for the slate industry in 1942 and 1943.

Salient statistics of the slate industry in the United States, 1942–43

	1942			1943				
	Quantity		Value	Quantity		Value	Percent of change in—	
	Unit of measurement	Approximate equivalent short tons		Unit of measurement	Approximate equivalent short tons		Quantity (unit as reported)	Value
Domestic production (sales by producers):	*Squares*			*Squares*				
Roofing slate	192,070	71,400	$1,704,053	96,220	35,370	$841,750	−49.9	−50.6
Mill stock:	*Sq. ft.*			*Sq. ft.*				
Electrical slate	692,680	6,640	543,531	550,790	4,730	451,427	−20.5	−16.9
Structural and sanitary slate	727,490	5,880	263,390	442,290	3,490	169,425	−39.2	−35.7
Grave vaults and covers	260,230	2,510	64,250	389,980	3,740	99,807	+49.9	+55.3
Blackboards and bulletin boards	804,860	1,980	178,002	466,160	1,160	100,981	−42.1	−43.3
Billiard-table tops	166,250	1,210	49,205	333,070	2,410	103,924	+100.3	+111.2
School slates	[1] 561,900	500	14,048	[1] 461,850	420	12,804	−17.8	−8.9
Total mill stock	3,213,410	18,720	1,112,426	2,644,140	15,950	938,368	−17.7	−15.6
Flagstones, etc.[2]	2,499,870	16,910	139,328	2,027,020	21,990	166,231	−18.9	+19.3
Total slate as dimension stone	....	107,030	2,955,807	....	73,310	1,946,349	−31.5	−34.2
Granules and flour	....	483,740	3,404,416	....	395,550	2,923,888	−18.2	−14.1
Grand total domestic production	....	590,770	6,360,223	....	468,860	4,870,237	−20.6	−23.4

[1] Square feet approximate. Number of pieces: 1942, 1,050,270; 1943, 863,270.
[2] Includes walkways, stepping stones, and miscellaneous slate.

SALES

Dimension slate.—Blocks or slabs cut to specified sizes and shapes are classed as dimension slate. This category includes all slate products except granules and flour. The following table shows sales of dimension slate for a 5-year period.

Slate (other than granules and flour) sold by producers in the United States, 1939–43

Year	Roofing			Mill stock		Other[1]		Total	
	Squares	Approximate equivalent short tons	Value	Approximate short tons	Value	Approximate short tons	Value	Approximate short tons	Value
1939	399,320	149,410	$2,868,961	21,710	$1,168,671	8,480	$63,493	179,600	$4,101,125
1940	347,180	127,600	2,436,123	17,070	935,810	9,780	64,435	154,450	3,436,368
1941	378,980	140,830	3,180,766	18,680	1,076,814	21,480	152,254	180,990	4,409,834
1942	192,070	71,400	1,704,053	18,720	1,112,426	16,910	139,328	107,030	2,955,807
1943	96,220	35,370	841,750	15,960	938,368	21,990	166,231	73,310	1,946,349

[1] Includes flagstones, walkways, stepping stones, and miscellaneous slate.

Figure 1 compares sales of roofing slate and mill stock with the number of new dwelling units and total new construction from 1920 to 1943. Roofing slate, which is used chiefly in residential construction, tends to follow the trend of activity in erection of new dwelling units, but since 1938 roofing-slate sales have failed to keep pace with it. In 1942 and 1943 new residential construction fell to an unusually low level, and the output of roofing slate declined correspondingly.

Mill-stock slate is used most widely in nonresidential building, but the types of construction that normally require slate have little place in the military program. Accordingly the great upsurge of new construction that characterized 1941 and 1942 afforded a minor stimulus to mill-stock sales, and the precipitous drop in total construction in 1943 was accompanied by a moderate recession in sales of slate from their low level of 1942. A return to the more permanent types of peacetime building would tend to stimulate a wider demand for structural slate.

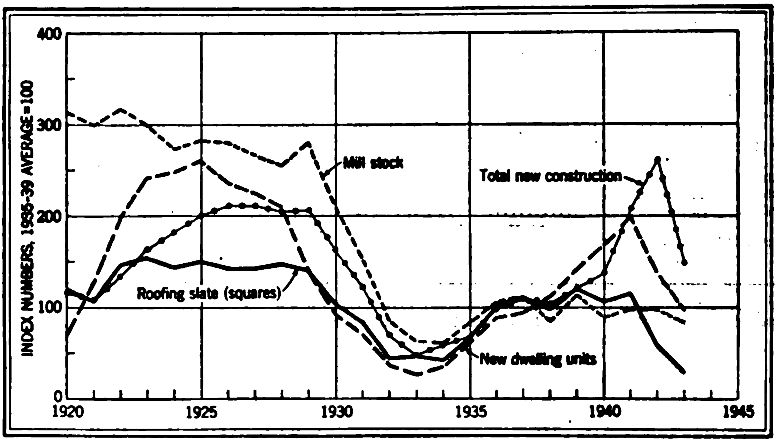

FIGURE 1.—Sales of roofing slate and mill stock compared with new dwelling units and total new construction, 1920–43. Data on new construction from Bureau of Foreign and Domestic Commerce and on new dwelling units from Bureau of Labor Statistics.

Figure 2 presents graphically a statistical history of slate over a 29-year period, by uses. Slate which, for the purpose of this figure, is designated "miscellaneous", including all mill stock except blackboards and bulletin boards as well as flagging, stepping stones, and other forms, maintained a value of sales nearly as high as in 1942, but roofing, blackboards, granules, and flour showed a marked decline.

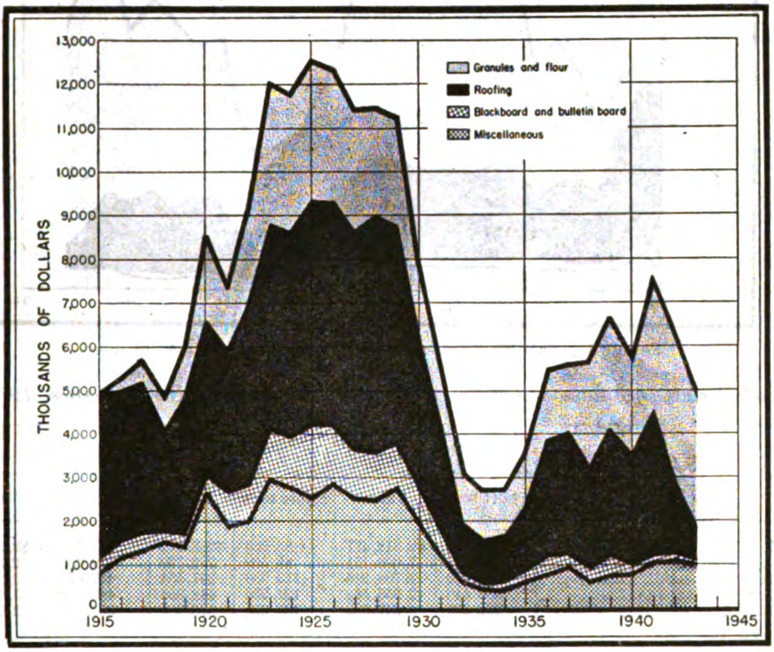

FIGURE 2.—Value of slate sold in the United States, 1915–43, by uses.

Figure 3 presents the history of slate production by kinds of products upon a quantity basis. Products of low unit value assume greater prominence in this chart than in figure 2, whereas the higher-priced products, such as blackboards, occupy a relatively insignificant place in figure 3.

Granules and flour.—Slate granules are used extensively in surfacing prepared roofing; and slate flour is employed as a filler in paints, road-asphalt surface mixtures, roofing mastic, oilcloth, and various other products. Although sales declined greatly in 1943 compared with 1942 they were, nevertheless, higher than in any pre-war year since 1929. The magnitude of sales was due chiefly to the wide use of granule-surfaced roofing on military establishments and war housing. Sales for a 5-year period are indicated in the accompanying table. The history of the industry and its more important technical and economic problems have been discussed in some detail by Josephson.[1]

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[1] Josephson, G. W., Roofing Granules: Am. Inst. of Min. and Met. Eng. Tech. Pub. 1725, 1943, 13 pp.

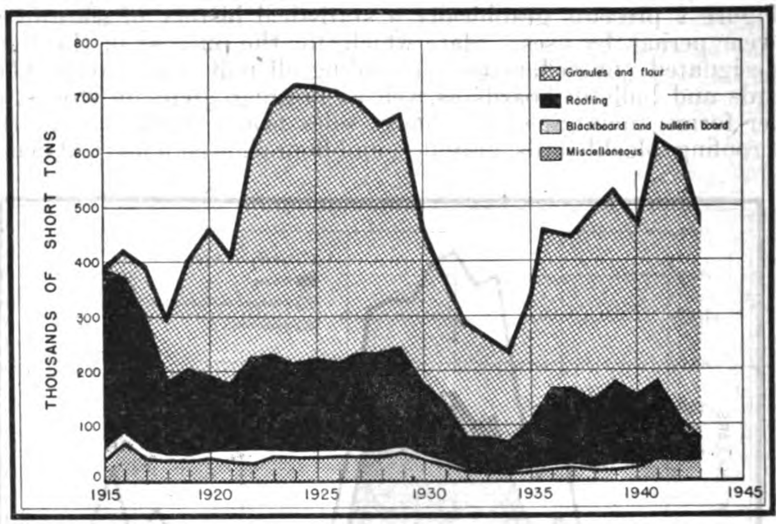

FIGURE 3.—Quantity of slate sold in the United States, 1915–43, by uses.

Crushed slate (granules and flour) sold by producers in the United States, 1939–43

Year	Granules		Flour		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	265, 830	$2, 312, 177	85, 950	$268, 912	351, 780	$2, 581, 089
1940	230, 440	2, 009, 151	88, 560	292, 750	319, 000	2, 301, 901
1941	323, 740	2, 708, 246	113, 930	397, 554	437, 670	3, 105, 800
1942	356, 510	2, 955, 562	127, 230	448, 854	483, 740	3, 404, 416
1943	292, 330	2, 547, 399	103, 220	376, 489	395, 550	2, 923, 888

PRICES

The average price of roofing slate, f. o. b. quarry or mill, as reported to the Bureau of Mines, decreased 12 cents a square in 1943 compared with 1942. In Pennsylvania it decreased 9 cents a square; in the New York-Vermont area it increased 43 cents, and in Virginia 90 cents.

The price of mill stock was unchanged at 35 cents a square foot. The average value of electrical slate increased 4 cents a square foot, structural and sanitary 2 cents, vaults and covers 1 cent, and billiard-table tops 1 cent; but the average value of blackboards remained unchanged. The sales value of granules and flour increased 35 cents a ton.

Price history.—Figure 4 shows the trend of slate prices compared with building materials in general over a 29-year period. Slate prices were lower than those of building materials from 1915 to 1920, but from that time until 1932 they were substantially above the average of all building materials. Since 1932 they have been in close accord, and in 1943 the index numbers were almost identical.

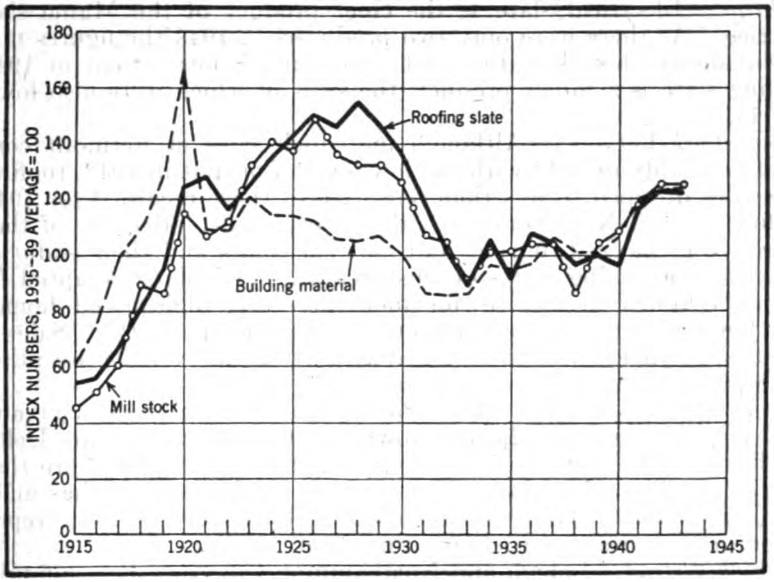

FIGURE 4.—Prices of slate compared with wholesale prices of building materials in general, 1915–43. Wholesale prices are from Bureau of Labor Statistics.

REVIEW BY STATES AND DISTRICTS

The following table gives sales of slate in 1943, by States and uses.

Slate sold by producers in the United States in 1943, by States and uses

State	Operators	Roofing		Mill stock		Other uses [1] (value)	Total value
		Squares (100 square feet)	Value	Square feet	Value		
Arkansas	1	-------	-------	-------	-------	[2]	[2]
California	1	-------	-------	-------	-------	[2]	[2]
Georgia	1	-------	-------	-------	-------	[2]	[2]
Maine	2	[2]	[2]	[2]	[2]	-------	[2]
Maryland	1	-------	-------	-------	-------	[2]	[2]
New York	5	120	$2,379	-------	-------	$611,187	$613,566
Pennsylvania [3]	21	77,270	648,237	2,129,740	$498,761	689,927	1,836,925
Vermont	12	[2]	[2]	[2]	[2]	1,145,378	1,284,288
Virginia	5	11,900	122,932	-------	-------	137,932	260,864
Undistributed	-------	6,930	68,202	514,400	439,607	505,700	874,594
Total: 1943	49	96,220	841,750	2,644,140	938,368	3,090,119	4,870,237
1942	68	192,070	1,704,063	3,213,410	1,112,426	3,543,744	6,360,223

[1] Flagging and similar products, granules, and flour.
[2] Included under "Undistributed."
[3] For details of production in Pennsylvania, see following table.

Maine.—Electrical slate is the chief product of the Maine slate quarries. As there were only two producers in 1943 the figures may not be shown; however, total sales were much lower than in 1942. Roofing slate is a minor product, the sales of which were also lower in 1943.

New York-Vermont.—Although mill-stock sales in Vermont compared favorably in 1943 with the low level of output in 1942, roofing-slate sales dropped to less than one-sixth of those recorded for 1942. Roofing sales in New York were almost negligible. Because of their attractive green, red, purple, and mottled colors and their enduring qualities, the roofing slates of this area are particularly adapted for public buildings as well as for moderate- and high-priced homes. Very few buildings in these categories were erected in 1943. Sales of granules, however, were maintained at fairly high levels because they find a place in wartime construction.

Peach Bottom district.—An area on the Maryland-Pennsylvania border, including the adjacent towns of Cardiff, Md., and Delta, Pa., has been the center of a slate-producing industry for more than 200 years. The sole roofing-slate producer in the territory has made slates since 1937. Granules and flour industries, which are represented in both States, experienced moderate declines.

Lehigh district.—Lehigh and Northampton Counties, Pa., comprise the most productive slate areas in the United States. Slate products of all the important kinds are made in this district. As separate figures may not be shown for York County, Pa., it is included with Northampton County in the accompanying table.

The value of total sales of slate products in the Lehigh district was 30 percent lower in 1943 than in 1942 and reached the lowest point in any year since 1935. Sales of roofing slate were down 39 percent in both quantity and value. The following mill-stock products gained in both quantity and value: Electrical slate (19 percent in quantity and 14 percent in value), vaults and covers (51 percent in quantity and 57 percent in value), and billiard-table tops (95 percent in quantity and 101 percent in value). The following products declined in both quantity and value: Structural and sanitary slate (38 percent in quantity and 34 percent in value), blackboards and bulletin boards (42 percent in quantity and 43 percent in value), and school slates (18 percent in quantity and 9 percent in value). Other products, chiefly granules and flour, decreased 29 percent in value compared with 1942.

Virginia.—Blue-black roofing slates are produced in Buckingham County. Sales were 43 percent less in quantity and 38 percent in value in 1943 than in 1942. Granules are produced at Esmont, Albermarle County, and New Canton, Buckingham County.

Other districts.—Slate granules and flour were produced near Mena, Polk County, Ark.; Placerville, Eldorado County, Calif.; and in Bartow County, Ga., near Fair Mount.

Slate sold by producers in Pennsylvania in 1943, by counties and uses

County	Operators	Roofing slate		Mill stock					
				Electrical		Structural and sanitary		Vaults and covers	
		Squares (100 square feet)	Value	Square feet	Value	Square feet	Value	Square feet	Value
Lehigh	6	7,140	$54,557	48,140	$20,022	1,170	$355	(1)	(1)
Northampton and York [2]	15	70,130	593,680	21,750	9,036	427,130	161,202	[1] 379,920	[1] $95,633
Total: 1943	21	77,270	648,237	69,890	29,058	428,300	161,557	379,920	95,633
1942	22	125,950	1,068,300	58,880	25,523	687,630	244,008	251,380	61,057

County	Mill stock—Continued						Other uses, value	Total value
	Blackboards and bulletin boards		Billiard-table tops		School slates			
	Square feet	Value	Square feet	Value	Square feet	Value		
Lehigh	122,640	$23,569			461,850	$12,804	(3)	[1 3] $111,307
Northampton and York [2]	343,520	77,412	323,620	$98,728			[3] $689,927	[1 3] 1,725,618
Total: 1943	466,160	100,981	323,620	98,728	461,850	12,804	689,927	1,836,925
1942	804,860	178,002	166,250	49,205	561,900	14,048	966,656	2,606,799

[1] Small amount of slate for grave vaults and covers produced in Lehigh County included under Northampton and York Counties.

[2] York County produced roofing slate, granules, and flour only.

[3] Small amount of flagging produced in Lehigh County included under Northampton and York Counties.

NEW DEVELOPMENTS

The Pennsylvania Legislature has authorized a slate-research program to be conducted by Pennsylvania State College over a 2-year period. Slate is being studied from five angles—(1) test methods, (2) mineral composition, (3) physical and chemical properties, (4) component minerals of slate waste and methods of utilizing them, and (5) qualities and characteristics of new products made of slate. Work in under way on all of them, with special emphasis on microscopic, X-ray, and chemical studies of component minerals and manufacture of expanded slate aggregates.

POST-WAR PROSPECTS

The slate industry reached in 1943 the most inactive period in its history. Roofing slate, the principal product, finds its chief market in new residential construction, and as extensive home building is forecast for the immediate post-war era there is a fair prospect of a substantial revival in roofing-slate sales. Similarly, accumulated post-war public-building construction will call for increasing quantities of structural slate. Slate meets keen competition for every use to which it is applied, and the future prosperity of the industry will depend primarily on the success with which it meets such competition.

FOREIGN TRADE

Recent figures on foreign trade were omitted from the chapter on Slate in Minerals Yearbook, 1942, because of military restrictions. These restrictions still apply to data for 1942 and 1943, but 1941 figures have been released and are shown herein.. Data for 9 months only of 1941 had been published heretofore.

Imports.—Imports of slate into the United States are very small. Figures, by countries of origin, from 1937 up to and including the first 9 months of 1941, are given in the chapter on Slate in Minerals Yearbook, 1941. Total imports for the year 1941 were valued at $1,648.

Exports.—The following table lists the value of exports of slate products from 1937 to 1941, as reported to the Bureau of Mines by shippers.

Slate exported from the United States, 1937–41, by uses [1]

Use	1937	1938	1939	1940	1941
Roofing	$9, 382	$5, 070	$5, 244	$5, 547	$4, 211
School slates	35, 011	35, 717	[2] 17, 739	[2] 36, 503	[2] 46, 490
Electrical	2, 356	1, 239	1, 726	4, 721	4, 644
Blackboards	6, 853	10, 400	8, 448	4, 688	5, 206
Billiard tables	16, 580	10, 182	18, 111	24, 197	46, 612
Structural [3]	4, 393	1, 314	5, 791	121, 038	158, 100
Slate granules and flour	77, 576	93, 675	120, 731		
	152, 151	157, 597	177, 790	196, 694	265, 263

[1] Figures collected by Bureau of Mines from shippers of products named.

[2] Includes slate used for pencils and educational toys.

[3] Includes slate for floors and walkways.

SAND AND GRAVEL

By G. W. Josephson and G. E. Tucker

SUMMARY OUTLINE

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SUMMARY

In 1943 the United States had passed the peak of war construction, and emphasis had shifted to the production of armament. As over 90 percent of the output of the sand and gravel industry is used in construction, volume declined substantially. On the other hand, the industrial sands, which have essential functions in a wide variety of manufacturing processes, attained a new record.

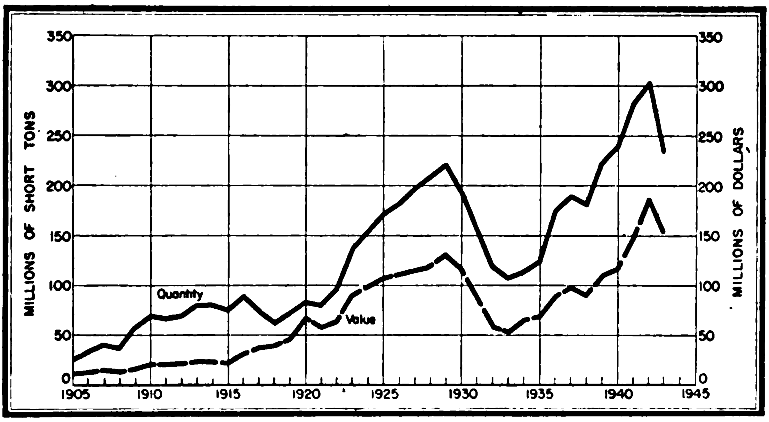

FIGURE 1.—Total production of sand and gravel in the United States, 1905–43.

Average values increased somewhat, but manpower, equipment, and other operating problems reduced production efficiency. Many plants experienced drastic reductions in volume as construction projects in their vicinity were completed. Even partly compensating demand from private or public construction programs was not expected to materialize until the war neared or reached its end.

POST-WAR OUTLOOK

It is generally agreed that a great backlog of demand for construction materials is being accumulated during the war. Road building and maintenance are being deferred. Many people want new dwellings. Whole new systems of dams are proposed. Even a considerable amount of industrial construction is anticipated, as many of the wartime structures have doubtful value under peacetime conditions.[1]

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[1] Pit and Quarry, Post-War Outlook: Vol. 36, No. 7, January 1944, pp. 73–114.

Substantial private and public expenditures will be required to maintain a high level of sand and gravel production. The outlook for industrial activity after the war appears to assure a high rate of private spending in the immediate post-war years. The prospects for public expenditures, however, are still obscure because of uncertainty as to the magnitude of post-war public works programs.

As industrial sands are closely geared to manufacturing, their welfare will depend on the degree of general prosperity attained.

Sand and gravel sold or used by producers in the United States, 1942–43, by commercial and Government-and-contractor operations and by uses

	1942			1943			Percent of change in—	
	Short tons	Value		Short tons	Value			
		Total	Average		Total	Average	Tonnage	Average value
COMMERCIAL OPERATIONS								
Sand:								
Glass	3,622,487	$6,784,427	$1.87	3,971,931	$7,376,566	$1.86	+9.6	−0.5
Molding	8,255,991	10,745,552	1.30	8,924,654	12,093,670	1.36	+8.1	+4.6
Building	46,035,701	26,901,356	.58	30,910,985	18,662,075	.60	−32.9	+3.4
Paving	33,307,106	20,035,796	.60	23,439,936	14,304,867	.61	−29.6	+1.7
Grinding and polishing [1]	806,878	1,363,168	1.69	837,662	1,428,463	1.71	+3.8	+1.2
Fire or furnace	368,465	491,972	1.34	394,753	539,273	1.37	+7.1	+2.2
Engine	2,559,008	1,749,204	.68	2,862,025	1,983,364	.69	+11.8	+1.5
Filter	176,833	223,137	1.26	158,555	258,547	1.63	−10.3	+29.4
Railroad ballast [2]	1,969,758	675,778	.34	1,319,896	411,938	.31	−33.0	−8.8
Other [3]	1,698,134	1,345,823	.79	1,461,977	1,180,190	.81	−13.9	+2.5
Total commercial sand	98,800,361	70,316,213	.71	74,282,374	58,238,953	.78	−24.8	+9.9
Gravel:								
Building	46,389,536	35,827,822	.77	31,121,915	24,395,097	.78	−32.9	+1.3
Paving	60,874,506	43,193,937	.71	49,050,490	35,769,203	.73	−19.4	+2.8
Railroad ballast [4]	23,110,558	8,377,991	.36	19,407,356	8,022,006	.41	−16.0	+13.9
Other [5]	3,772,826	1,711,310	.45	2,607,121	1,476,862	.57	−30.9	+26.7
Total commercial gravel	134,147,426	89,111,060	.66	102,186,882	69,663,168	.68	−23.8	+3.0
Total commercial sand and gravel	232,947,787	159,427,273	.68	176,469,256	127,902,121	.72	−24.2	+5.9
GOVERNMENT-AND-CONTRACTOR OPERATIONS [6]								
Sand:								
Building	3,482,000	2,018,000	.58	3,187,000	1,757,000	.55	−8.5	−5.2
Paving	5,089,000	2,109,000	.41	4,584,000	2,267,000	.49	−9.9	+19.5
Total Government-and-contractor sand	8,571,000	4,127,000	.48	7,771,000	4,024,000	.52	−9.3	+8.3
Gravel:								
Building	8,022,000	3,942,000	.49	4,106,000	2,803,000	.68	−48.8	+38.8
Paving	54,806,000	21,004,000	.38	45,718,000	18,064,000	.40	−16.6	+5.3
Total Government-and-contractor gravel	62,828,000	24,946,000	.40	49,824,000	20,867,000	.42	−20.7	+5.0
Total Government-and-contractor sand and gravel	71,399,000	29,073,000	.41	57,595,000	24,891,000	.43	−19.3	+4.9
COMMERCIAL AND GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand	107,371,000	74,443,000	.69	82,053,000	62,263,000	.76	−23.6	+10.
Gravel	196,975,000	114,057,000	.58	152,011,000	90,530,000	.60	−22.8	+3.4
Grand total	304,346,000	188,500,000	.62	234,064,000	152,793,000	.65	−23.1	+4.8

[1] Includes blast sand as follows—1942: 422,922 tons valued at $1,071,018; 1943: 450,997 tons, $1,138,003.

[2] Includes ballast sand produced by railroads for their own use as follows—1942: 39,352 tons valued at $8,740; 1943: 28,032 tons, $5,399.

[3] Includes some sand used by railroads for fills and similar purposes as follows—1942: 178,191 tons valued at $27,500; 1943: 170,372 tons, $23,974.

[4] Includes ballast gravel produced by railroads for their own use as follows—1942: 10,243,680 tons valued at $2,031,339; 1943: 7,661,118 tons, $1,957,362.

[5] Includes some gravel used by railroads for fills and similar purposes as follows—1942: 1,294,861 tons valued at $141,917; 1943: 1,176,243 tons, $256,318.

[6] Approximate figures for States, counties, municipalities, and other Government agencies directly or under lease.

PRODUCTION

After increasing almost continuously during the previous 9 years, production of sand and gravel in 1943 declined 23 percent below the record set in 1942. The reduction was almost entirely in the construction types; the industrial sands attained a record tonnage 9 percent greater than in 1942. As producers' stocks of sand and gravel are comparatively small in tonnage and do not vary greatly from year to year, production virtually equals sales, and the two terms are used interchangeably throughout this report. The following table summarizes the production of sand and gravel in the United States during the past 5 years.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States, 1939–43

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	72,542,000	$41,608,000	153,466,000	$64,458,000	226,008,000	$106,066,000
1940	78,674,000	45,332,000	159,634,000	65,356,000	238,308,000	110,688,000
1941	103,835,000	62,152,000	184,880,000	85,055,000	288,715,000	147,207,000
1942	107,371,000	74,443,000	196,975,000	114,057,000	304,346,000	188,500,000
1943	82,053,000	62,263,000	152,011,000	90,530,000	234,064,000	152,793,000

California was again the leading producer, followed by Illinois, Texas, Ohio, and Michigan in that order. Six States exceeded 10 million tons in 1943, whereas nine reported that quantity in 1942. Details of production in 1943, by States and uses, are presented in the following tables.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States

State	Short tons	Value	State	Short tons	Value
Alabama	3,704,777	$2,029,186	New Hampshire	611,582	$126,325
Alaska	(1)	(1)	New Jersey	[1] 5,020,373	[1] 5,217,688
Arizona	855,671	649,006	New Mexico	[1] 230,458	[1] 147,624
Arkansas	[1] 2,648,986	[1] 1,715,704	New York	[1] 7,375,378	[1] 5,256,547
California	29,025,759	18,548,747	North Carolina	3,046,168	1,823,516
Colorado	1,575,949	915,664	North Dakota	1,459,232	550,263
Connecticut	1,729,052	837,069	Ohio	12,569,930	10,003,339
Delaware	186,923	99,409	Oklahoma	2,141,705	1,191,929
Florida	1,833,453	1,527,985	Oregon	[1] 4,013,846	[1] 3,473,708
Georgia	655,335	467,440	Pennsylvania	9,279,469	9,251,344
Idaho	4,699,745	4,276,960	Puerto Rico	(1)	(1)
Illinois	13,722,449	9,882,322	Rhode Island	356,043	327,750
Indiana	8,062,568	4,535,533	South Carolina	452,166	217,280
Iowa	5,070,927	1,979,559	South Dakota	2,291,450	701,034
Kansas	3,615,861	2,103,091	Tennessee	2,922,752	2,285,339
Kentucky	2,298,328	1,452,298	Texas	12,679,989	8,523,820
Louisiana	3,835,749	3,046,172	Utah	2,536,518	1,322,544
Maine	1,603,324	733,503	Vermont	227,618	101,918
Maryland	4,658,609	4,115,389	Virginia	4,668,708	4,775,935
Massachusetts	3,321,047	1,941,241	Washington	[1] 5,183,374	[1] 3,403,720
Michigan	11,750,989	5,588,850	West Virginia	2,654,434	3,596,006
Minnesota	8,575,915	2,105,143	Wisconsin	6,223,375	2,595,531
Mississippi	[1] 1,855,207	[1] 1,098,745	Wyoming	2,224,941	978,460
Missouri	3,250,533	2,298,556	Undistributed [2]	18,537,000	10,497,000
Montana	2,553,080	1,155,621			
Nebraska	4,526,610	2,391,463		234,064,000	152,793,000
Nevada	1,741,011	929,347			

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[1] Output of Government-and-contractor operations included under "Undistributed."

[2] Includes items covered by "1."

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States and uses

[Commercial unless otherwise indicated]

State	Sand							
	Glass		Molding		Building			
					Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			113,125	$93,777	677,158	$264,620	11,031	$4,190
Alaska							(1)	(1)
Arizona					167,308	149,558		
Arkansas	(1)	(1)	(1)	(1)	227,260	129,495	(1)	(1)
California	122,308	$404,541	128,159	398,199	4,339,910	2,678,956	1,603,751	423,660
Colorado			(1)	(1)	184,362	98,803	3,873	4,422
Connecticut	3,000	18,000	(1)	(1)	506,932	301,697	147,912	14,791
Delaware			4,399	1,988	46,440	31,015		
Florida	2,400	2,400			773,055	574,575		
Georgia	18,982	37,963	(1)	(1)	247,051	120,816		
Idaho					29,137	19,382	2,468	2,472
Illinois	(1)	(1)	2,211,889	2,796,981	2,037,700	939,606		
Indiana			280,386	180,731	835,040	430,040	2,727	1,600
Iowa			(1)	(1)	601,852	325,336		
Kansas			1,000	663	596,516	295,114	5,130	1,230
Kentucky			(1)	(1)	321,154	210,530	182,018	76,196
Louisiana			(1)	(1)	759,221	402,000		
Maine					71,140	26,586	2,500	2,500
Maryland	21,500	32,250			912,753	758,337		
Massachusetts			(1)	(1)	875,985	481,322	748	648
Michigan	(1)	(1)	1,485,475	687,386	1,200,863	481,412	2,110	410
Minnesota	(1)	(1)	21,715	26,205	568,535	239,327	1,676	538
Mississippi					192,009	90,859	(1)	(1)
Missouri	(1)	(1)	155,799	166,821	484,328	249,770	270	100
Montana					104,162	82,775	6,197	1,285
Nebraska					484,701	223,571	395	167
Nevada	34,087	98,067	21,724	52,971	(1)	(1)		
New Hampshire					2,650	1,325		
New Jersey	383,067	500,922	1,723,418	2,821,666	1,351,154	660,700	(1)	(1)
New Mexico					(1)	(1)	(1)	(1)
New York			432,777	734,689	2,227,480	1,258,701	(1)	(1)
North Carolina					313,149	127,044	24,300	9,825
North Dakota					17,978	11,246	21,750	912
Ohio	(1)	(1)	1,010,927	1,862,123	1,809,531	1,190,681	540	160
Oklahoma	(1)	(1)	(1)	(1)	376,553	268,514	16,878	35,456
Oregon			(1)	(1)	301,923	337,822	(1)	(1)
Pennsylvania	(1)	(1)	614,300	1,197,961	2,173,838	1,862,944		
Puerto Rico							(1)	(1)
Rhode Island			(1)	(1)	(1)	(1)		
South Carolina					157,174	74,492		
South Dakota					97,621	68,856	218	60
Tennessee	11,086	22,171	154,754	272,055	580,004	503,029	26,505	17,274
Texas	(1)	(1)	(1)	(1)	1,300,736	819,026	67,305	6,839
Utah			(1)	(1)	201,817	97,528	15,593	6,450
Vermont					(1)	(1)	2,330	172
Virginia	(1)	(1)	35,856	34,083	981,868	752,105	4,244	3,582
Washington			(1)	(1)	875,155	493,672	(1)	(1)
West Virginia	(1)	(1)	(1)	(1)	181,879	176,640	138	60
Wisconsin			227,432	239,484	627,163	274,647	23,952	11,081
Wyoming					7,572	10,452	286	21
Undistributed [2]	3,375,501	6,260,252	301,519	525,887	81,168	67,149	1,011,000	1,131,000
	3,971,931	7,376,566	8,924,654	12,093,670	30,910,985	18,662,075	3,187,000	1,757,000

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States and uses—Continued

State	Sand—Continued							
	Paving				Grinding and polishing [2]		Fire or furnace	
	Commercial		Government-and-contractor					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	543,004	$218,019	6,882	$4,096	------	------	2,500	$1,750
Alaska	------	------	------	------	------	------	------	------
Arizona	86,356	73,459	6,297	2,629	------	------	------	------
Arkansas	270,162	154,242	------	------	(1)	(1)	(1)	(1)
California	3,655,216	2,153,149	269,394	164,404	(1)	(1)	(1)	(1)
Colorado	15,825	11,375	155,689	86,484	1,131	$1,006	------	------
Connecticut	75,436	46,128	179,517	22,011	(1)	(1)	------	------
Delaware	46,739	23,370	------	------	2,830	5,660	100	125
Florida	427,602	264,887	17,600	1,600	------	------	------	------
Georgia	286,765	217,464	------	------	10,849	12,961	------	------
Idaho	201,092	192,578	20,790	14,880	------	------	------	------
Illinois	947,525	551,692	21,537	15,457	(1)	(1)	57,767	68,552
Indiana	845,377	464,004	20,068	9,831	------	------	(1)	(1)
Iowa	183,885	116,613	24,851	10,086	(1)	(1)	------	------
Kansas	863,800	459,218	43,873	8,827	2,263	1,263	------	------
Kentucky	362,289	269,446	13,000	7,025	------	------	------	------
Louisiana	458,958	297,225	------	------	(1)	(1)	------	------
Maine	6,750	3,750	166,830	102,272	(1)	(1)	------	------
Maryland	925,801	667,332	10,753	910	(1)	(1)	(1)	(1)
Massachusetts	439,105	254,923	88,463	34,211	(1)	(1)	------	------
Michigan	1,317,610	642,881	92,797	46,310	153,628	43,203	------	------
Minnesota	215,661	83,205	74,766	11,934	150	412	135	135
Mississippi	282,245	150,853	(1)	(1)	281	141	------	------
Missouri	378,165	225,630	1,350	100	(1)	(1)	(1)	(1)
Montana	4,013	2,564	26,362	15,164	------	------	------	------
Nebraska	255,167	124,673	------	------	(1)	(1)	------	------
Nevada	69,261	66,020	------	------	------	------	------	------
New Hampshire	21,175	10,587	262,214	33,036	------	------	------	------
New Jersey	437,584	206,346	(1)	(1)	(1)	(1)	45,900	59,256
New Mexico	------	------	(1)	(1)	------	------	------	------
New York	1,551,287	856,460	(1)	(1)	------	------	(1)	(1)
North Carolina	692,615	269,029	818,403	242,627	(1)	(1)	------	------
North Dakota	18,258	10,178	9,483	6,158	------	------	------	------
Ohio	1,716,360	1,070,930	35,380	7,105	(1)	(1)	121,475	261,461
Oklahoma	439,445	223,616	13,353	3,424	------	------	------	------
Oregon	192,639	202,975	(1)	(1)	------	------	------	------
Pennsylvania	1,089,854	934,106	------	------	(1)	(1)	63,502	95,260
Puerto Rico	------	------	(1)	(1)	------	------	------	------
Rhode Island	(1)	(1)	24,770	6,177	------	------	------	------
South Carolina	159,170	50,075	13,921	4,288	(1)	(1)	(1)	(1)
South Dakota	3,929	2,182	13,395	5,520	------	------	------	------
Tennessee	351,252	301,661	22,901	15,500	9,870	17,643	888	1,851
Texas	1,751,586	1,178,728	163,792	98,011	(1)	(1)	------	------
Utah	177,778	112,223	9,129	5,807	(1)	(1)	------	------
Vermont	(1)	(1)	2,485	1,359	(1)	(1)	------	------
Virginia	707,419	506,505	86,214	31,112	------	------	------	------
Washington	474,047	273,144	(1)	(1)	(1)	(1)	------	------
West Virginia	259,293	236,636	16,942	11,929	(1)	(1)	------	------
Wisconsin	185,790	89,376	91,646	24,866	33,604	69,998	648	360
Wyoming	3,039	2,172	16,373	10,123	------	------	------	------
Undistributed [3]	43,607	33,238	1,743,000	1,202,000	623,056	1,276,176	101,838	50,523
	23,439,936	14,304,867	4,584,000	2,267,000	837,662	1,428,463	394,753	539,273

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States and uses—Continued

State	Sand—Continued							
	Engine		Filter		Railroad ballast [4]		Other [5]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	-------	-------	-------	-------	-------	-------
Alaska	-------	-------	-------	-------	-------	-------	-------	-------
Arizona	19,555	$14,577	-------	-------	-------	-------	(1)	(1)
Arkansas	(1)	(1)	(1)	(1)	(1)	(1)	-------	-------
California	(1)	(1)	7,013	$30,312	38,337	$18,877	98,417	$71,359
Colorado	43,090	34,626	(1)	(1)	(1)	(1)	17,309	5,329
Connecticut	-------	-------	12,756	5,685	1,000	400	22,993	10,633
Delaware	66,715	26,685	584	1,314	-------	-------	2,476	1,972
Florida	-------	-------	(1)	(1)	4,740	930	(1)	(1)
Georgia	(1)	(1)	1,062	4,250	-------	-------	61,414	39,697
Idaho	-------	-------	-------	-------	-------	-------	2,712	2,805
Illinois	170,563	86,548	(1)	(1)	(1)	(1)	144,338	149,396
Indiana	179,715	66,785	-------	-------	175,954	44,408	(1)	(1)
Iowa	56,330	41,449	(1)	(1)	5,670	1,495	24,052	11,303
Kansas	124,803	78,507	3,988	10,021	4,444	1,655	63,173	37,292
Kentucky	(1)	(1)	-------	-------	-------	-------	(1)	(1)
Louisiana	11,214	5,154	-------	-------	(1)	(1)	3,508	1,075
Maine	2,192	1,218	-------	-------	-------	-------	4,133	1,699
Maryland	(1)	(1)	-------	-------	-------	-------	(1)	(1)
Massachusetts	31,208	19,178	(1)	(1)	(1)	(1)	80,775	28,238
Michigan	(1)	(1)	(1)	(1)	157,509	41,070	65,710	33,350
Minnesota	17,794	4,568	250	688	(1)	(1)	73,623	20,529
Mississippi	14,255	5,776	-------	-------	-------	-------	(1)	(1)
Missouri	27,774	14,474	(1)	(1)	128,048	34,427	70,177	100,680
Montana	-------	-------	-------	-------	12,150	2,156	29,745	7,726
Nebraska	68,195	27,278	-------	-------	14,619	6,728	40,186	7,149
Nevada	-------	-------	-------	-------	-------	-------	11,649	29,964
New Hampshire	-------	-------	-------	-------	-------	-------	-------	-------
New Jersey	58,700	31,576	40,280	79,102	-------	-------	18,753	18,594
New Mexico	(1)	(1)	-------	-------	-------	-------	-------	-------
New York	90,560	40,581	20,321	9,031	20,321	9,032	71,474	34,147
North Carolina	38,760	26,532	(1)	(1)	88,815	27,067	(1)	(1)
North Dakota	-------	-------	-------	-------	3,020	1,500	119	9
Ohio	85,331	67,315	(1)	(1)	(1)	(1)	(1)	(1)
Oklahoma	63,819	33,177	(1)	(1)	-------	-------	1,246	112
Oregon	(1)	(1)	-------	-------	25,410	13,233	(1)	(1)
Pennsylvania	412,232	499,419	-------	-------	-------	-------	106,447	127,072
Puerto Rico	-------	-------	-------	-------	-------	-------	-------	-------
Rhode Island	-------	-------	(1)	(1)	-------	-------	-------	-------
South Carolina	(1)	(1)	(1)	(1)	4,300	430	(1)	(1)
South Dakota	-------	-------	-------	-------	-------	-------	600	150
Tennessee	(1)	(1)	(1)	(1)	373	466	2,738	4,394
Texas	84,279	39,163	(1)	(1)	16,596	5,880	30,256	12,297
Utah	(1)	(1)	-------	-------	-------	-------	(1)	(1)
Vermont	(1)	(1)	-------	-------	-------	-------	(1)	(1)
Virginia	100,160	45,894	-------	-------	-------	-------	(1)	(1)
Washington	(1)	(1)	-------	-------	2,250	1,100	(1)	(1)
West Virginia	390,347	367,272	-------	-------	-------	-------	(1)	(1)
Wisconsin	(1)	(1)	(1)	(1)	61,361	13,919	9,334	3,147
Wyoming	2,835	2,625	456	1,216	-------	-------	4,725	1,750
Undistributed [2]	701,599	393,987	71,845	116,928	554,979	187,165	399,895	418,322
	2,862,025	1,983,364	158,555	258,547	1,319,896	411,938	1,461,977	1,180,190

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States and uses—Continued

State	Gravel							
	Building				Paving			
	Commercial		Government-and-contractor		Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	1,071,526	$722,775	4,183	$4,165	(1)	(1)	154,956	$12,642
Alaska	--------	--------	(1)	(1)	--------	--------	(1)	(1)
Arizona	230,560	235,090	--------	--------	147,775	$103.117	87,909	23,425
Arkansas	403,541	284,939	(1)	(1)	632,527	462,461	(1)	(1)
California	5,483,194	4,061,973	2,582.707	1,699.514	5,075,951	3,474,731	4,843.757	2,645,030
Colorado	208,495	163,635	13,192	7,489	152,232	132,654	728.991	333,512
Connecticut	526,480	301,563	--------	--------	103,596	62,741	112,879	38,724
Delaware	2,240	2,240	--------	--------	14,400	5,040	--------	--------
Florida	530,647	590,147	--------	--------	52.750	64,250	--------	--------
Georgia	--------	--------	--------	--------	10,395	23,100	--------	--------
Idaho	35,255	31,368	63,969	88,071	2,834,193	2,816,383	1,124,764	987,777
Illinois	2,018,322	1,130,081	19,095	3,991	2,279,514	1,113,508	662,275	315,802
Indiana	848,042	621,702	84,190	15,140	2,801,267	1,795,468	265,449	97,905
Iowa	447,708	372,152	--------	--------	1,313,061	584.264	1,996,029	283,096
Kansas	125,332	101,563	15,116	594	1,041,104	801,899	717,895	294,807
Kentucky	261,422	171,565	110,901	56,371	336,567	273,687	372,505	183,105
Louisiana	1,269,014	1,109,986	--------	--------	952,033	1,010,833	37,428	12,663
Maine	68,710	54,111	72,520	99,280	126,770	80,543	972,873	319,773
Maryland	963,981	1,162,220	--------	--------	1,280,636	1,329,468	502,378	102,726
Massachusetts	622,681	505,959	830	718	777,105	444,801	199,662	50,000
Michigan	1,321,258	711,724	135,060	14,682	3,469,252	1,816,308	1,712,555	584,272
Minnesota	482,421	392,890	683	692	511,397	343,692	4,233,467	314,217
Mississippi	668,138	499,945	(1)	(1)	460,573	270,591	(1)	(1)
Missouri	503,766	282,418	200	125	523,032	295,036	349,216	134,472
Montana	29,667	28,200	792	1,374	270,522	245,991	923.459	395,195
Nebraska	769,189	405,654	18,225	4,445	2,578,092	1,425,527	267,297	141,042
Nevada	(1)	(1)	454	84	763,714	337,297	389,262	169,529
New Hampshire	4,983	6,229	35,000	3,500	16,118	20,029	263,843	42,545
New Jersey	359,994	317,542	--------	--------	479,031	263,584	(1)	(1)
New Mexico	(1)	(1)	(1)	(1)	--------	--------	(1)	(1)
New York	1,429,426	1,172,731	(1)	(1)	1,378,652	918.473	(1)	(1)
North Carolina	177,369	211,538	--------	--------	644.802	751,567	143,120	51,407
North Dakota	53,265	31,387	16,200	600	157,501	106.782	504,578	128,299
Ohio	1,430,035	1.059,570	--------	--------	3,853,834	2,600.150	453.049	111,572
Oklahoma	50,960	31,525	--------	--------	275,984	229,983	778,115	146,233
Oregon	753,386	573,326	(1)	(1)	2.294,984	2,124.420	(1)	(1)
Pennsylvania	2,241,781	1,923,879	--------	--------	1,578,281	1,222,724	113,388	29.791
Puerto Rico	--------	--------	(1)	(1)	--------	--------	(1)	(1)
Rhode Island	(1)	(1)	--------	--------	(1)	(1)	37,980	26,592
South Carolina	21,698	19,387	--------	--------	12,082	10,270	9.872	2.789
South Dakota	16,109	19.978	25.885	2,425	78,004	72.553	1,651,214	435,856
Tennessee	454.520	363,436	81,640	45,073	548.508	435.960	363.902	92,461
Texas	2,010.616	1.847,016	13,651	19,813	2,900.971	2,681,219	2,071,717	600,976
Utah	176,940	85,896	1,100	623	573,755	395,220	1,102.494	473.995
Vermont	(1)	(1)	270	400	35,555	30,695	109.693	29.650
Virginia	1,176,830	1,596.235	2,304	2.319	1,114,666	1,292.750	191,676	116,603
Washington	1,051,319	643,247	(1)	(1)	1,872,324	1.711,243	(1)	(1)
West Virginia	171,927	161,020	2.950	1.092	309,152	285,609	126.449	31,063
Wisconsin	502,871	259,418	64,202	23,884	1,398,757	600,409	1,726,659	592,762
Wyoming	22,365	33,924	574	42	275,369	174,437	372,297	253,364
Undistributed [2]	123,932	93,913	740,000	706,000	743,702	527,736	15,043.000	7,458,000
	31,121,915	24,395,097	4,106,000	2,803,000	49,050,490	35,769,203	45,718,090	18,064.000

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1943, by States and uses—Continued

State	Gravel—Continued				Sand and gravel			
	Railroad ballast [6]		Other [7]		Total commercial		Total Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	(1)	(1)	3, 527, 725	$2, 004, 093	177, 052	$25, 093
Alaska	--------	--------	--------	--------	--------	--------	(1)	(1)
Arizona	(1)	(1)	35, 078	$28, 232	761, 465	622, 952	94, 206	26, 054
Arkansas	955, 320	$443, 079	(1)	(1)	2, 648, 986	1, 715, 704	(1)	(1)
California	516, 086	79, 772	137, 905	87, 695	19, 726, 150	13, 616, 139	9, 299, 609	4, 932, 608
Colorado	32. 065	24, 963	17, 884	9, 814	674, 204	483, 757	901, 745	431, 907
Connecticut	--------	--------	35, 234	13, 545	1, 288, 744	761, 543	440, 308	75, 526
Delaware	--------	--------	--------	--------	186, 923	99, 409	--------	--------
Florida	(1)	(1)	663	3, 646	1, 815, 853	1, 526, 385	17, 600	1, 600
Georgia	--------	--------	--------	--------	655, 335	467, 440	--------	--------
Idaho	(1)	(1)	(1)	(1)	3, 487, 754	3, 183, 760	1, 211, 991	1, 093, 200
Illinois	1, 666, 146	726, 482	73, 315	34, 297	13, 019, 542	9, 547, 072	702, 907	335, 250
Indiana	1, 519, 275	721, 367	100, 830	37, 550	7, 690, 134	4, 411, 057	372, 434	124, 476
Iowa	360, 110	148, 804	2, 915	14, 008	3, 050, 047	1, 686, 377	2, 020, 880	293, 182
Kansas	400	260	7, 024	10, 158	2, 833, 847	1, 797, 633	782, 014	305, 458
Kentucky	(1)	(1)	(1)	(1)	1, 619, 904	1, 129, 601	678, 424	322, 697
Louisiana	248, 324	153, 874	(1)	(1)	3, 798, 321	3, 033, 509	37, 428	12, 663
Maine	(1)	(1)	14, 816	3, 798	388, 601	209, 678	1, 214, 723	523, 825
Maryland	--------	--------	--------	--------	4, 145, 478	4, 011, 753	513, 131	103, 636
Massachusetts	(1)	(1)	67, 355	11, 519	3, 031, 344	1, 855, 664	289, 703	85, 577
Michigan	467, 586	240, 187	55, 565	24, 622	9, 808, 467	4, 943, 176	1, 942, 522	645, 674
Minnesota	1, 816, 079	503, 137	463, 313	124, 385	4. 265, 323	1, 777, 762	4, 310, 592	327, 381
Mississippi	196, 051	54, 859	(1)	(1)	1, 855, 207	1, 098, 745	(1)	(1)
Missouri	250, 153	157, 938	2, 875	754	2, 899, 497	2, 163, 759	351, 036	134, 797
Montana	905, 987	309, 732	240, 024	63, 459	1, 596, 270	742, 603	956, 810	413, 018
Nebraska	22, 790	21, 461	(1)	(1)	4, 240, 593	2, 245, 809	285, 917	145, 654
Nevada	425, 213	149, 362	--------	--------	1, 351, 295	759, 734	389, 716	169, 613
New Hampshire	--------	--------	5, 599	9. 074	50, 525	47, 244	561, 057	79, 081
New Jersey	(1)	(1)	15, 282	28, 007	5, 020, 373	5, 217, 688	(1)	(1)
New Mexico	(1)	(1)	--------	--------	230, 458	147, 624	(1)	(1)
New York	(1)	(1)	147, 370	209, 713	7, 375, 378	5, 256, 547	(1)	(1)
North Carolina	(1)	(1)	(1)	(1)	2, 060, 345	1, 519, 657	985, 823	303, 859
North Dakota	539, 383	230, 140	117, 697	23, 052	907, 221	414, 294	552, 011	135, 969
Ohio	1, 347, 179	649, 697	241, 936	266, 173	12, 080, 961	9, 884, 502	488, 969	118, 837
Oklahoma	--------	--------	(1)	(1)	1, 333, 359	1, 006, 816	808, 346	185, 113
Oregon	347, 579	167, 268	78, 218	47, 036	4, 013, 846	3, 473, 708	(1)	(1)
Pennsylvania	144, 000	107, 415	30, 568	28, 962	9, 166, 081	9, 221, 553	113. 388	29, 791
Puerto Rico	--------	--------	--------	--------	--------	--------	(1)	(1)
Rhode Island	--------	--------	(1)	(1)	293, 293	294, 981	62, 750	32, 769
South Carolina	12, 150	2, 107	--------	--------	428, 373	210, 203	23, 793	7, 077
South Dakota	341, 367	78, 777	63, 108	14, 677	600, 738	257, 173	1, 690, 712	443, 861
Tennessee	(1)	(1)	28, 915	27, 614	2, 428, 804	2, 115, 031	493, 948	170, 308
Texas	2, 153, 198	958, 552	30, 260	41, 571	10, 363, 524	7, 798, 181	2, 316. 465	725, 639
Utah	254, 979	135, 404	2, 485	869	1, 408, 202	835, 669	1, 128, 316	486, 875
Vermont	13, 186	2, 613	1, 800	300	112, 840	70, 337	114. 778	31, 581
Virginia	209, 790	330, 148	--------	--------	4, 384, 270	4, 622, 319	284, 438	153, 616
Washington	543, 785	116, 041	(1)	(1)	5, 183, 374	3, 403, 720	(1)	(1)
West Virginia	(1)	(1)	--------	--------	2, 507, 955	3, 551, 862	146, 479	44, 144
Wisconsin	1, 064, 739	307, 195	(1)	(1)	4, 316, 916	1, 942, 988	1, 906, 459	652, 543
Wyoming	1, 487, 769	482, 110	31, 281	6, 224	1, 835, 411	714, 910	389, 530	263, 550
Undistributed [2]	1, 566, 667	719, 242	557, 806	306, 108	--------	--------	18, 537, 000	10, 497, 000
	19, 407, 356	8, 022, 006	2. 607, 121	1, 476, 862	176, 469, 256	127, 902, 121	57, 595, 000	24, 891, 000

[1] Included under "Undistributed."
[2] Includes items entered as "1."
[3] Includes 450,997 tons of blast sand valued at $1,138,003.
[4] Includes 28,032 tons of ballast sand valued at $5,399, produced by railroads for their own use.
[5] Includes 170,372 tons of sand valued at $23,974, used by railroads for fills and similar purposes.
[6] Includes 7,661,118 tons of ballast gravel valued at $1,957,362, produced by railroads for their own use.
[7] Includes 1,176,243 tons of gravel valued at $256,318, used by railroads for fills and similar purposes.

Government-and-contractor production.—Trends in Government-and-contractor production of sand and gravel noted in 1942 continued in 1943. Total output was 19 percent lower than in 1942. The contraction in this phase of the industry is indicated by the fact that in 1943 it produced 46 percent less than in 1939 whereas the same comparison for commercial operations shows 49 percent greater tonnage.

The decline was uniform among the various Government units; States reported 32 percent of the total, counties 25, municipalities 2, and other agencies (principally Federal organizations) 41—nearly the same percentages as in 1942.

Direct production by Government agencies continued to decline. In 1940 contractors supplied only 27 percent of the total tonnage, but by 1943 their contribution had increased to 56 percent.

Although it increased little in 1943 the average value, reflecting higher costs, is more than one-third higher than before the war. Other details are shown in the following tables.

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1939–43, by uses

Year	Sand				Gravel				Total Government-and-contractor sand and gravel	
	Building		Paving		Building		Paving			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
		Dollars		*Dollars*		*Dollars*		*Dollars*		*Dollars*
1939	5,815,000	2,255,000	9,114,000	2,767,000	10,896,000	5,586,000	81,790,000	24,275,000	107,615,000	34,883,000
1940	5,149,000	2,039,000	9,595,000	2,767,000	9,866,000	4,922,000	82,442,000	22,690,000	107,052,000	32,418,000
1941	5,789,000	1,797,000	12,876,000	4,013,000	8,779,000	3,797,000	79,715,000	22,893,000	107,159,000	32,500,000
1942	3,482,000	2,018,000	5,089,000	2,109,000	8,022,000	3,942,000	54,806,000	21,004,000	71,399,000	29,073,000
1943	3,187,000	1,757,000	4,584,000	2,267,000	4,106,000	2,803,000	45,718,000	18,064,000	57,595,000	24,891,000

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1940–43, by types of producers

Type of producer	1940		1941		1942		1943	
	Short tons	Average value per ton	Short tons	Average value per ton	Short tons	Average value per ton	Short tons	Average value per ton
Construction and maintenance crews	78,615,000	$0.28	66,234,000	$0.27	36,911,000	$0.29	25,348,000	$0.31
Contractors	28,437,000	.37	40,925,000	.36	34,488,000	.53	32,247,000	.53
	107,052,000	.30	107,159,000	.30	71,399,000	.41	57,595,000	.43
States	36,657,000	.26	39,177,000	.26	23,334,000	.31	18,076,000	.42
Counties	21,685,000	.22	22,772,000	.20	18,841,000	.21	14,504,000	.27
Municipalities	1,923,000	.28	1,637,000	.29	1,397,000	.29	1,191,000	.32
Other agencies	46,787,000	.38	43,573,000	.40	27,827,000	.63	23,824,000	.54
	107,052,000	.30	107,159,000	.30	71,399,000	.41	57,595,000	.43

METHOD OF TRANSPORTATION

Tire, gasoline, manpower, and maintenance problems are making the operation of trucks increasingly difficult. These difficulties are reflected in a trend toward rail transportation. Despite the fact that there was much less sand and gravel to move, commercial producers shipped a larger percentage of their output by rail than by truck in 1943; from 1938 to 1942 trucking had predominated. However, when the Government-and-contractor tonnage is considered trucks still lead by a wide margin. Waterways handle only a small fraction of the national total, but locally their facilities are important.

Sand and gravel sold or used by commercial producers in the United States, 1942–43, by methods of transportation [1]

Method of transportation	1942		1943	
	Short tons	Percent of total reported	Short tons	Percent of total reported
Truck	103,777,190	47.4	67,475,351	42.4
Rail	93,456,656	42.7	77,700,918	48.8
Waterway	21,603,759	9.9	13,974,693	8.8
Total reported	218,837,605	100.0	159,150,957	100.0
Percent of total commercial production covered		94.0		90.0

[1] For practical purposes the entire output of Government-and-contractor operations commonly is moved by truck. Including Government-and-contractor production, sand and gravel moved as follows—1942: Truck 60 percent, rail 32 percent, and waterway 8 percent; 1943: Truck 58 percent, rail 36 percent, and waterway 6 percent.

DEGREE OF PREPARATION

During the past 5 years 86 to 88 percent of the commercial tonnage has required preparation to meet specifications, whereas only 21 to 34 percent of the Government-and-contractor material has been prepared. Much of the sand and gravel produced during the past 2 years has gone into construction of war facilities that required close adherence to quality standards. This fact and the curtailment of public projects that use large quantities of unprepared material have combined to increase the over-all degree of preparation to 71 percent in 1943 (72 percent in 1942), substantially higher than the 63 percent averaged during 1935–39. As shown in the accompanying table, 92 percent of the processed tonnage was handled in commercial plants in 1943. As processing adds materially to the cost of the product, the average value of commercial output is always higher than that from Government-and-contractor operations.

Sand and gravel (prepared or unprepared) sold or used by producers in the United States, 1942–43, by commercial and Government-and-contractor operations

	1942			1943		
	Quantity		Average value per ton	Quantity		Average value per ton
	Short tons	Percent		Short tons	Percent	
Commercial operations:						
Prepared	200,131,369	86	$0.73	152,788,204	87	$0.77
Unprepared	32,816,418	14	.38	23,681,052	13	.43
	232,947,787	100	.68	176,469,256	100	.72
Government-and-contractor operations:						
Prepared	20,076,000	28	.67	12,963,000	23	.75
Unprepared	51,323,000	72	.30	44,632,000	77	.34
	71,399,000	100	.41	57,595,000	100	.43
Grand total	304,346,000		.62	234,064,000		.65

SIZE OF PLANTS

Average plant size, which has increased greatly since 1940, began to readjust back toward the pre-war distribution. Average plant production declined from 87,000 tons in 1942 to 73,000 in 1943. The ranks of the very large plants, producing over 500,000 tons yearly, were depleted from 76 in 1942 to 39 in 1943, and their percentage of the total tonnage dropped from 29.2 percent to 20.6. Half of the total output was contributed by the 29.7 percent that reported between 50,000 and 300,000 tons in 1943. Nearly half the plants produced less than 25,000 tons. Details of output, by size groups, for 1942 and 1943, are given in the following table.

Comparison of number and output of commercial sand and gravel plants in the United States, 1942–43, by size groups [1]

Size group, in short tons	1942				1943			
	Plants [2]		Production		Plants [2]		Production	
	Number	Percent of total	Short tons	Percent of total	Number	Percent of total	Short tons	Percent of total
Less than 25,000	1,258	49.2	10,225,000	4.6	1,119	48.6	9,429,000	5.6
25,000 and less than 50,000	366	14.3	13,139,000	5.9	393	17.1	13,924,000	8.3
50,000 and less than 100,000	336	13.1	24,591,000	11.1	323	14.0	22,717,000	13.6
100,000 and less than 200,000	299	11.7	42,193,000	19.1	258	11.2	35,934,000	21.5
200,000 and less than 300,000	132	5.2	32,312,000	14.6	104	4.5	24,944,000	14.9
300,000 and less than 400,000	56	2.2	19,361,000	8.7	34	1.5	11,936,000	7.1
400,000 and less than 500,000	34	1.3	14,981,000	6.8	31	1.4	14,047,000	8.4
500,000 and less than 600,000	24	1.0	13,046,000	5.9	11	.5	6,057,000	3.6
600,000 and less than 700,000	14	.5	8,918,000	4.0	9	.4	5,897,000	3.5
700,000 and less than 800,000	12	.5	8,972,000	4.1	5	.2	3,768,000	2.3
800,000 and less than 900,000	5	.2	4,112,000	1.9	5	.2	4,589,000	2.7
900,000 and less than 1,000,000	3	.1	2,819,000	1.3				
1,000,000 and over	18	.7	26,523,000	12.0	9	.4	14,191,000	8.5
	2,557	100.0	221,192,000	100.0	2,301	100.0	167,433,000	100.0

[1] Plants operated by or for States, counties, municipalities and other Government agencies are not included; also not included are approximately 172 railroad plants with an output of 11,756,000 tons of sand and gravel in 1942 and 165 plants with an output of 9,036,000 tons in 1943.

[2] Includes a few companies operating more than 1 plant but not submitting separate returns for individual plants.

PRINCIPAL TRENDS

Sand and gravel for construction.—Contract awards in the construction industry declined sharply in 1943. Building of war plants and other military facilities was nearing completion, and private building was discouraged by wartime limitations on the production and sale of hardware, wood, and other essential components. As erection programs based upon previous contracts were still active, consumption of sand and gravel did not decrease as much as contracts; consequently, further reductions are likely in 1944. Figure 2 shows the correlation between sales of sand and gravel and construction activity during the past 11 years.

Industrial sands.—In contrast with the construction types, industrial sand consumption continued to increase in 1943. As nearly all of these sands enter directly into manufacturing or closely allied operations they will be in great demand as long as production of war goods remains at a high level. Figures 3 and 4 show graphically the details of production of these sands in past years and their correlation with trends in industrial production.

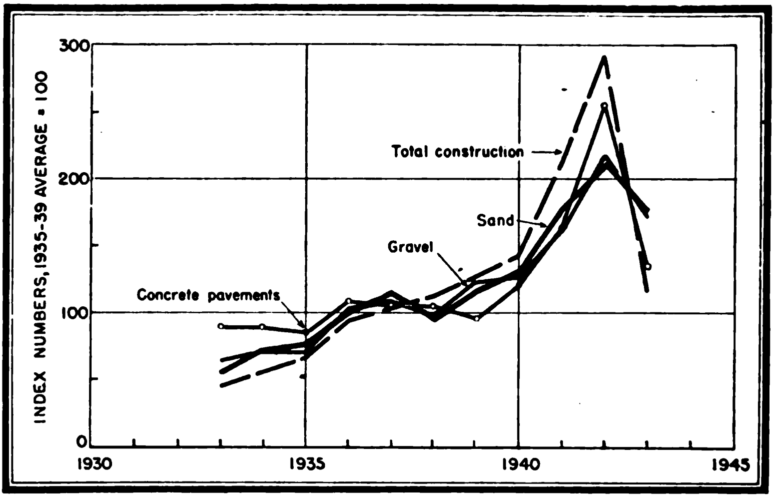

FIGURE 2.—Value of sand and gravel production compared with total construction (value) and concrete pavements (contract awards, thousands of square yards) in the United States, 1933–43. Data on construction and concrete pavements from Bureau of Foreign and Domestic Commerce.

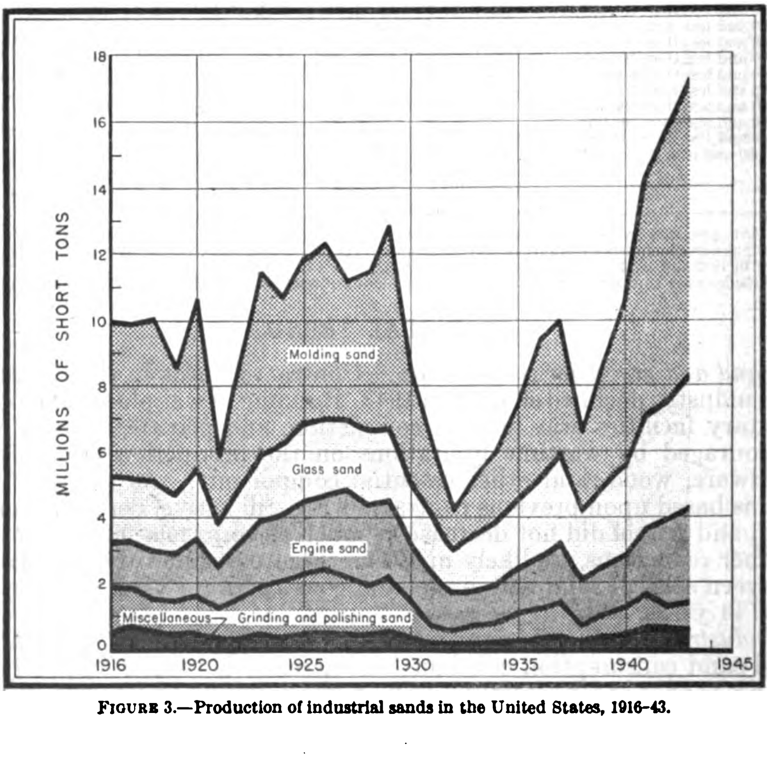

FIGURE 3.—Production of industrial sands in the United States, 1916–43.

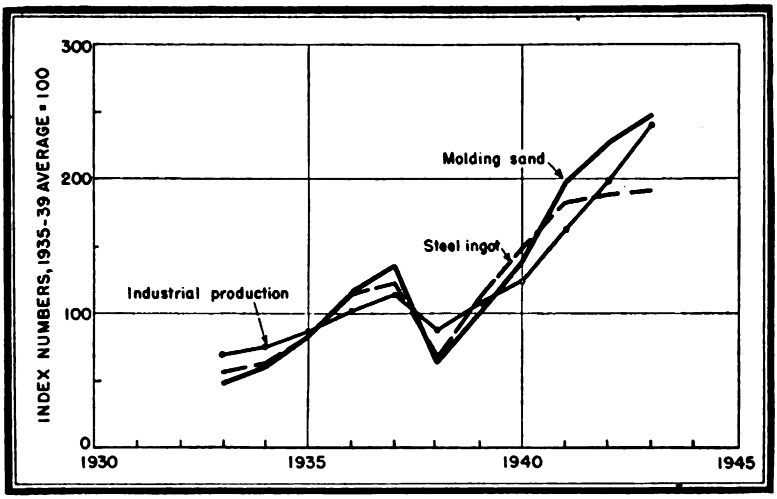

FIGURE 4.—Trends in production of molding sand compared with industrial production and output of steel ingots, 1933–43. Index of industrial production from Federal Reserve Board; statistics of steel-ingot production compiled by American Iron and Steel Institute.

EMPLOYMENT AND PRODUCTIVITY

Employment in the commercial sand and gravel industry reached a peak of nearly 32,000 men in 1942 and then declined to about 26,000 in 1943. Output per man-hour continued nearly as high in 1942 as in 1941 but declined to the pre-war level in 1943. As shown in the regional tables, this loss in efficiency, generally attributed to labor turn-over and reduced production, was Nation-wide. The number of working days per year increased in 1943, and owing to the manpower shortage the average length of shift remained at nearly 9 hours. The reports of operators who produce about four-fifths of the total tonnage are summarized in the accompanying tables.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States, 1937–43 [1]

Year	Employment					Production			Percent of commercial industry represented
	Average number of men	Time employed				Commercial sand and gravel (short tons)	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1937	16,062	215	3,458,994	8.6	29,754,746	97,113,001	28.1	3.3	81.8
1938	14,971	201	3,001,796	8.5	25,578,807	81,742,896	27.2	3.2	81.1
1939	15,617	214	3,335,321	8.4	28,054,960	96,755,364	29.0	3.5	81.7
1940	16,595	217	3,596,886	8.4	30,263,744	101,143,305	28.1	3.3	77.1
1941	19,909	228	4,530,488	8.6	38,978,128	144,594,925	31.9	3.7	79.6
1942	25,061	227	5,679,695	8.9	50,694,303	183,255,772	32.3	3.6	78.7
1943	20,308	234	4,743,721	8.9	42,041,878	138,113,786	29.1	3.3	78.3

[1] Excludes plants operated by or directly for States, counties, municipalities, and other Government agencies.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States in 1942–43, by regions [1]

Region	Employment					Production			Percent of commercial industry represented
	Average number of men	Time employed				Commercial sand and gravel (short tons)	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours					
				Average per man per day	Total		Per shift	Per hour	
1942									
Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, and Connecticut	913	193	176, 426	8. 6	1, 518, 069	7, 747, 976	43. 9	5. 1	82. 6
New York	1, 470	213	312, 796	8. 5	2, 665, 845	11, 515, 555	36. 8	4. 3	84. 7
Pennsylvania, New Jersey, and Delaware	2, 687	255	684, 443	8. 6	5, 912, 756	16, 176, 839	23. 6	2. 7	97. 1
West Virginia, Virginia, Maryland, and District of Columbia	1, 530	268	410, 170	9. 3	3, 826, 043	8, 293, 386	20. 2	2. 2	60. 6
South Carolina, Georgia, Alabama, Florida, and Mississippi	1, 520	265	402, 526	9. 5	3, 807, 377	9, 190, 164	22. 8	2. 4	90. 1
North Carolina, Kentucky, and Tennessee	1, 356	256	347, 010	9. 4	3, 255, 699	8, 348, 413	24. 1	2. 6	93. 4
Arkansas, Louisiana, and Texas	2, 548	263	670, 095	9. 8	6, 572, 312	16, 508, 719	24. 6	2. 5	74. 7
Ohio	1, 715	224	383, 910	8. 5	3, 261, 047	10, 357, 951	27. 0	3. 2	77. 9
Illinois and Indiana	2, 273	223	506, 681	8. 7	4, 400, 787	24, 729, 694	48. 8	5. 6	86. 0
Michigan and Wisconsin	1, 410	209	294, 148	8. 9	2, 613, 819	12, 756, 239	43. 4	4. 9	70. 3
North Dakota, South Dakota, and Minnesota	823	167	137, 171	8. 2	1, 130, 909	4, 485, 396	32. 7	4. 0	56. 2
Nebraska and Iowa	872	148	129, 262	9. 7	1, 252, 528	5, 737, 750	44. 4	4. 6	59. 7
Kansas, Missouri, and Oklahoma	1, 188	229	271, 987	9. 1	2, 463, 286	9, 211, 649	33. 9	3. 7	92. 6
Wyoming, Colorado, New Mexico, Utah, and Arizona	585	173	101, 120	8. 6	867, 393	4, 575, 749	45. 3	5. 3	50. 2
California and Nevada	2, 147	256	548, 725	8. 4	4, 611, 870	22, 011, 053	40. 1	4. 8	88. 0
Montana, Washington, Oregon, and Idaho	2, 024	150	303, 225	8. 4	2, 534, 563	11, 609, 239	38. 3	4. 6	70. 2
Total United States	25, 061	227	5, 679, 695	8. 9	50, 694, 303	183, 255, 772	32. 3	3. 6	78. 7
1943									
Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, and Connecticut	725	185	133, 908	8. 8	1, 171, 836	4, 213, 797	31. 5	3. 6	81. 6
New York	984	202	198, 590	8. 4	1, 666, 767	6, 405, 240	32. 3	3. 8	86. 8
Pennsylvania, New Jersey, and Delaware	2, 352	260	610, 543	8. 9	5, 444, 410	14, 097, 698	23. 1	2. 6	98. 1
West Virginia, Virginia, Maryland, and District of Columbia	1, 538	282	433, 638	9. 2	3, 970, 632	7, 843, 459	18. 1	2. 0	71. 1
South Carolina, Georgia, Alabama, Florida, and Mississippi	1, 065	265	282, 286	9. 0	2, 543, 284	6, 817, 546	24. 2	2. 7	82. 3
North Carolina, Kentucky, and Tennessee	958	262	250, 891	9. 0	2, 250, 638	5, 335, 386	21. 3	2. 4	87. 3
Arkansas, Louisiana, and Texas	1, 740	260	451, 658	9. 4	4, 252, 485	9, 968, 438	22. 1	2. 3	59. 3
Ohio	1, 452	247	358, 013	8. 5	3, 058, 594	8, 880, 501	24. 8	2. 9	73. 5
Illinois and Indiana	1, 949	231	450, 610	8. 7	3, 931, 531	17, 717, 819	39. 3	4. 5	85. 6

See footnote at end of table.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States in 1942–43, by regions [1]—Continued

Region	Employment					Production			Percent of commercial industry represented
	Average number of men	Time employed				Commercial sand and gravel (short tons)	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours					
				Average per man per day	Total		Per shift	Per hour	
1943—Continued									
Michigan and Wisconsin	1,385	198	274,037	9.1	2,483,466	10,747,551	39.2	4.3	76.1
North Dakota, South Dakota, and Minnesota	500	126	62,849	8.8	555,554	2,236,880	35.6	4.0	38.7
Nebraska and Iowa	840	181	152,236	9.7	1,479,795	5,937,115	39.0	4.0	81.4
Kansas, Missouri, and Oklahoma	1,047	247	258,094	8.6	2,223,707	6,611,080	25.6	3.0	93.6
Wyoming, Colorado, New Mexico, Utah, and Arizona	526	212	111,577	8.3	928,886	3,199,030	28.7	3.4	65.2
California and Nevada	1,751	269	471,562	8.4	3,944,318	18,620,544	39.5	4.7	88.3
Montana, Washington, Oregon, and Idaho	1,496	163	243,229	8.8	2,135,975	9,481,702	39.0	4.4	66.4
Total United States	20,308	234	4,743,721	8.9	42,041,878	138,113,786	29.1	3.3	78.3

[1] Excludes plants operated by or directly for States, counties, municipalities, and other Government agencies.

PRICES

Most classes of sand and gravel showed modest increases in ton value in 1943. Commercial operators reported that sand averaged 9.9 and gravel 3.0 percent higher than in 1942; comparable figures for Government-and-contractor output were 8.3 and 5.0 percent, respectively. Details covering unit and total values for each class of sand and gravel are contained in the summary table at the beginning of this chapter.

Prices of sand and gravel were under the provisions of Maximum Price Regulation 188. In general, the ceiling prices established by the General Maximum Price Regulation were continued, but in a few instances upward revisions were approved by the Office of Price Administration. Adjustments were on an individual company or a marketing-area basis, rather than for the entire industry.

NEW DEVELOPMENTS

During the past few years, consumers have steadily raised the quality standards required of sand and gravel products. Demand for increased fines in aggregates is stimulating interest in methods of meeting the specifications and is leading to the introduction of additional processing equipment.[2]

Although treatment of sand to prevent stripping when used in asphalt road surfacing has not gained much headway, interest is being shown in various quarters, and experimental work is progressing.[3]

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[2] Rock Products, Changing Sand Size Distribution: Vol. 46, No. 7, July 1943, pp. 50–51. Walker, Stanton, Processing Sands: Rock Products, vol. 46, No. 9, September 1943, p. 48.

[3] Janssen, A. S., Furfural as an Anti-Stripping Agent: British Chem. and Physiol. Abs., October 1943, p. 410.

Derivatives of natural resins are expanding their sales in the foundry sand market. This binder is claimed to allow reuse of a high percentage of reclaimed sand.[4]

A new product that can be of importance to the glass-sand industry was introduced in 1943. A structural material of moldable plastic reinforced with glass fibers is said to have physical properties that compare favorably with metals and also to possess unique advantages in rapid low-cost fabrication.[5]

FOREIGN TRADE

Sand and gravel of all qualities are so abundant in the United States that the imported tonnage is a very small factor in the industry. During the period 1935–39 imports averaged only a little over 400,000 tons per year—about 0.23 percent of domestic production. During the same period exports averaged less than 50,000 tons annually. Tables showing foreign trade statistics for the years 1932–40 and 1941 (9 months only) were published in the Sand and Gravel chapter of Minerals Yearbook 1942. Owing to wartime restrictions no figures on current foreign trade can be published, but they will be released at the end of the war to preserve the continuity of the statistical record.

BLAST-FURNACE SLAG

The total output of air-cooled screened and unscreened, water-granulated, and lightweight slag for 1943 was 16,507,607 short tons compared with 19,122,718 tons for 1942. Sales of air-cooled slag were 4 percent less in 1943 than in 1942, and the average value per ton of screened declined 2 cents and unscreened 3 cents. These figures are based upon a canvass, conducted by the National Slag Association, of the 32 companies that prepare blast-furnace slag for commercial use, and the results were assembled in cooperation with the Bureau of Mines.

Air-cooled slag was used principally in the construction and maintenance of highways, access roads, airport runways, defense-plant and housing projects, miscellaneous structures, and as railroad ballast and sewage trickle filter media. Other uses and quantities involved are shown in the accompanying table.

Virtually all the commercial output is produced east of the Mississippi River, chiefly at steel centers in Ohio, Alabama, Pennsylvania, and Illinois. Shipments, however, are made into all States east of the Mississippi, except some of the New England States outside the economic range of source of supply. Shipments of slag are made by railroad, truck, and waterway. The accompanying tabulation shows the pattern of distribution during the past 4 years.

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[4] Personal communication from E. Pragoff, Hercules Powder Co.

[5] Slayter, Games, The Role of Minerals in Our Future Economy: Min. and Met., vol. 24, No. 444, December 1943, pp. 546–550.

Shipments of commercial slag in the United States, 1940–43, by methods of transportation[1]

[Percent of total]

Method of transportation	1940	1941	1942	1943
Rail	55	55	52	56
Truck	44	43	47	44
Waterway	1	2	1	(2)

[1] National Slag Association.
[2] Less than 0.5 percent.

The average shipping range of blast-furnace slag in 1943 was 57 miles by rail, 14 by truck, and 157 by waterway. Generally shipments did not exceed 100 miles by railroad, 30 by truck, and 280 by waterway.

During the process of crushing and screening blast-furnace slag, particles of metallic iron that escape through the slag notch of the blast furnace are recovered at the slag plant by means of hand-picking and magnetic pulleys. During 1943 the companies surveyed reported 154,207 tons of metallic iron recovered and returned to the furnaces to bolster the supply of metal so vitally needed in the prosecution of the war. The yield slightly exceeds 1.1 percent or approximately 23 pounds of metallic iron per short ton of slag processed.

Not including those assigned to administrative, office, and sales activities, 1,550 plant and yard employees were engaged in producing commercial slag in 1943. The total number of man-hours in production was 4,194,496.

Air-cooled blast-furnace slag sold or used by producers in the United States, 1942–43, by States[1]

State	1942			1943		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Alabama	3,936,500	25.1	$2,793,924	4,379,490	29.0	$3,066,708
Ohio	4,492,497	28.7	4,080,896	3,722,825	24.7	3,284,040
Pennsylvania	2,522,437	16.1	2,354,024	2,342,858	15.5	2,204,186
Other States[2]	4,714,073	30.1	3,488,004	4,656,248	30.8	3,699,756
	15,665,507	100.0	12,716,848	15,101,421	100.0	12,254,690

[1] National Slag Association.
[2] Illinois, New York, Maryland, Michigan, West Virginia, Kentucky, Colorado, Tennessee, and Massachusetts.

Blast-furnace slag sold or used by producers in the United States, in 1943, by uses[1]

Use	Air-cooled						Granulated			Lightweight		
	Screened			Unscreened								
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton		Total	Average per ton
Concrete pavements and structures	1, 881, 396	$1, 674, 513	$0. 89	-------	-------	-------	-------	-------	-------	-------	-------	-------
Roads other than concrete	6, 304, 594	5, 867, 870	. 93	445, 044	$256, 545	$0. 58	701, 657	$147, 649	$0. 21	-------	-------	-------
Railroad ballast	2, 880, 760	1, 846, 062	. 64	365, 743	134, 197	. 37	-------	-------	-------	-------	-------	-------
Airport runways	1, 495, 376	1, 270, 578	. 85	9, 728	3, 007	. 31	-------	-------	-------	-------	-------	-------
Mineral wool	324, 930	326, 713	1. 01	4, 008	3, 407	. 85	-------	-------	-------	-------	-------	-------
Roofing slag	167, 561	225, 187	1. 34	-------	-------	-------	-------	-------	-------	-------	-------	-------
Sewage trickle filter	89, 937	115, 727	1. 29	-------	-------	-------	-------	-------	-------	-------	-------	-------
Agricultural slag	39, 099	38, 600	. 99	-------	-------	-------	28, 919	22, 608	. 78	-------	-------	-------
Cement manufacture	-------	-------	-------	-------	-------	-------	454, 871	77, 300	. 17	-------	-------	-------
Concrete products	-------	-------	-------	-------	-------	-------	-------	-------	-------	76, 971	$112, 817	$1. 47
Other uses	552, 989	348, 975	. 63	540, 256	143, 309	. 27	143, 768	71, 864	. 50	-------	-------	-------
Total: 1943	13, 736, 642	11, 714, 225	. 85	1, 364, 779	540, 465	. 40	1, 329, 215	319, 421	. 24	76, 971	112, 817	1. 47
1942	13, 591, 896	11, 832, 670	. 87	2, 073, 611	884, 178	. 43	3, 457, 211	587, 094	. 17	-------	-------	-------
1941	12, 372, 218	10, 434, 187	. 84	797, 363	390, 082	. 49	1, 508, 685	239, 833	. 16	-------	-------	-------
1940	8, 132, 396	7, 015, 616	. 86	1, 230, 832	507, 288	. 41	989, 814	257, 737	. 26	-------	-------	-------
1939	7, 108, 061	5, 870, 582	. 83	812, 220	361, 554	. 45	1, 188, 094	122, 017	. 10	-------	-------	-------

[1] National Slag Association.

GYPSUM

By Forrest T. Moyer and M. G. Downey

SUMMARY OUTLINE

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SUMMARY

The wartime controls on construction continued to have a depressing effect on the gypsum industry through 1943, and general activity fell sharply. The reduction in rate of operations from 1942 may be gaged by the 19-percent decrease in new crude supply to a total of 4,108,864 short tons and the 16-percent drop in production of calcined gypsum to 2,557,730 tons in 1943. However, the rate of decline in over-all activity was eased markedly through 1943, and in the fourth quarter the trend was nearly horizontal. Demand increased for certain prefabricated materials, and sales of wallboard and laminated board advanced to record volumes in 1943. In contrast, demand for the "built-in" products—plasters, lath, and tile—fell well below the 1942 level. Sales of all classes of industrial plasters advanced over the tonnage sold in 1942. Of the uncalcined products, the slump in indicated consumption of portland-cement retarder was offset partly by the increased sales of agricultural gypsum, which rose to a new high annual total in 1943. As a result of the strong demand for the relatively higher-valued prefabricated materials, the mill value of total sales by the industry decreased only 6 percent from 1942 to $59,096,532 in 1943. Regulation of prices of gypsum products by the Federal Government was continued through 1943 under maximum Price Regulation 188, and no changes were made in the permitted maximums, which had been frozen at the March 1942 levels.

The decline in general activity of the gypsum industry in 1943 was much less severe than the sharp drop in total construction. New construction activity in 1943 was estimated by the United States Department of Commerce to be 43 percent below 1942, and data of the Dodge Corporation on residential building contracts fell 52 percent in 1943. The favorable comparison for the gypsum industry may be attributed to the strong demand for some prefabricated products, industrial plasters, and agricultural gypsum, which cushioned the abrupt declines in sales of plasters, lath, tile, and cement retarder.

A basic cause of the selectivity in demand for gypsum products in 1943 as in 1942 was the war control on building. This regulation, Conservation Order L-41 of War Production Board, effective since April 9, 1942, was amended several times in 1943, and the revised form of November 1 appeared to be more restrictive in total effect on new construction than prior ones. The stoppage of nonessential public and private building under the order had resulted in a sharp decline in demand for lath, tiles, and building plasters. However, markets for wallboard, sheathing, and laminated board were enlarged by the gradual tightening in supplies of 1-inch construction lumber. The joint War Housing Construction Standards of the National Housing Agency and War Production Board, which were continued through 1943, prohibited the use of lumber for housing when suitable substitutes were available.

Salient statistics of the gypsum industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Active establishments [1]	92	91	93	92	85
Crude gypsum [2]—					
Mined ... short tons	3,226,737	3,699,015	4,788,534	4,697,568	3,877,541
Imported ... do	1,308,078	1,405,210	1,347,957	394,460	231,323
Apparent supply ... do	4,534,815	5,104,225	6,136,491	[3] 5,092,028	4,108,864
Calcined gypsum produced: [4]					
Short tons	2,881,269	3,307,709	3,980,567	3,045,082	2,557,730
Value	$14,620,597	$17,254,667	$19,746,914	$16,403,068	$14,751,587
Gypsum products sold: [4]					
Uncalcined uses:					
Short tons	867,782	929,119	1,320,713	1,514,913	1,233,727
Value	$1,927,415	$2,250,857	$3,138,958	$3,533,607	$3,114,789
Industrial uses:					
Short tons	110,395	123,643	151,960	142,705	163,500
Value	$1,373,564	$1,532,738	$1,885,313	$1,840,927	$2,258,981
Building uses:					
Value	$42,627,260	$49,709,049	$64,734,171	$57,796,210	$53,722,762
Total value	$45,928,239	$53,492,644	$69,758,442	$63,170,744	$59,096,532
Gypsum and gypsum products—					
Imported for consumption	$1,363,967	$1,429,289	$1,282,140	$508,321	$304,070
Exported	$309,453	$264,128	$529,574	$977,863	$283,720

[1] Each mine, plant, or combination mine and plant is counted as 1 establishment.
[2] Excludes byproduct gypsum.
[3] Revised figure.
[4] Made from domestic, imported, and byproduct crude gypsum.

To alleviate a shortage of gypsum boards in the Pacific coast region, the Office of Price Administration issued the following amendments to Order A-1 under Maximum Price Regulation 188: Amendment 13, effective September 18, 1943; Amendment 19, effective December 1, 1943; Amendment 24, effective January 7, 1944; and Amendment 31, effective March 24, 1944. Under these special pricing provisions, gypsum boards for installation in projects under control of specified Federal Government agencies could be shipped into Arizona, California, Oregon, and Washington from plants as far east as Ohio at set mill prices plus full freight costs. The amendments differed only in the types of board and number of Government agencies included in the provisions. Amendment 31 applied to all types of board and is to expire July 1, 1944. Use of the special pricing amendments set up a means of relieving the board shortage without any adjustment of the March 1942 ceiling prices on these products in the consuming area. The Office of Price Administration ruled that, except in cases of proved hardship, gypsum producers who sell upon a delivered basis should not pass on but should absorb the 3-percent transportation tax of December 31, 1942. The ruling, which affects only the Pacific coast region and certain metropolitan areas in other sections of the country, was upheld by the Emergency Court of Appeals and the Supreme Court.

The feature of the industry was the marked demand for wallboard and laminated board, which was fostered in part by the shortage of 1-inch lumber and continued throughout 1943 despite the rapid decline in structural activity. Early in 1943 demand for wallboard appeared to be relatively strong in nearly all parts of the country, but by the fourth quarter only the record demand in the Pacific and Southern States maintained the high volume of sales. The rate of increase in sales had flattened to nearly a horizontal trend in the fourth quarter, and the long-term trend apparently was approaching a peak. Consumption of laminated products, which had been introduced about the middle of 1942, was nearly four times larger in 1943 than in 1942. In wartime construction, the laminated boards compete rather severely with sheathing, and as demand for the laminated products was maintained through 1943 that for sheathing declined.

Sales of the "built-in" gypsum materials—lath, building plasters, and tiles—declined in 1943 in contrast with the rising demand for the completely finished prefabricated products. Indicated consumption of lath fell sharply below that in 1942. However, the downtrend in sales of this product was interrupted during the October-December period for the first time since the trend started downward in the second quarter of 1942. The square footage of lath sold in the fourth quarter of 1943 was nearly one-fifth larger than in the corresponding period of 1942 and also advanced contraseasonally over the quantity sold in the third quarter of 1943. Demand for building plasters as a group slumped in 1943 with sales of base-coat and gauging and molding plasters, the important tonnage items, falling, respectively, 38 and 30 percent below those in 1942. Sales of these types declined at a rapid rate early in 1943, but by the October-December period the rate of decrease had eased markedly. The nearly similar behavior in trends of these companion products and of lath through 1943 would indicate that sales of the "built-in" materials may have fallen to the minimum required for necessary building and repair work.

The source composition of the new crude supply showed further changes in 1943. Owing to war restrictions on shipping, imports of crude fell to the lowest annual total since 1919 and represented only 6 percent of the new supply compared with 8 percent in 1942 and 22 percent in 1941. Although crude supplies were short at Atlantic tidal plants, the critical situation was mitigated somewhat by the fact that the greater demand for gypsum products in 1943 was in sections of the country not served from these plants. To provide relief for the supply problem at the processing plants on the Atlantic coast, substantial shipments of calcined gypsum were made from western New York into the New York City and Philadelphia areas and from western Virginia to the Georgia and Florida plants. In addition, the calcined output of a byproduct-gypsum plant was utilized at other nearby processing plants in the New York City area. Stocks of crude gypsum in the country on December 31 totaled 480,737 short tons, of which 126,304 tons were at Atlantic tidewater plants. Similar data for December 31, 1942, were total stocks of 741,549 tons, with 152,581 tons at the tidal plants.

The progressive easement in the rate of decline of new crude supply and calcined production through 1943 is depicted clearly by the flattening of the long-term trend curves of these materials in figure 1. The convergence of the new-crude-supply and domestic-crude-mined curves through 1942 and 1943 illustrates the drastic curtailment in crude imports, a condition that resulted in the lesser rate of decline in domestic mine output.

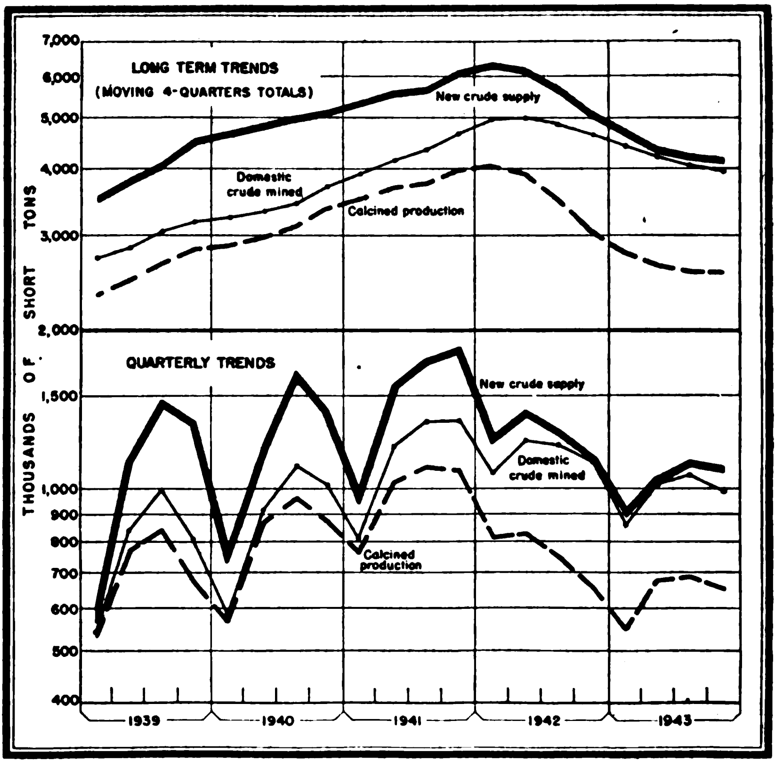

FIGURE 1.—Trends of new crude supply, domestic crude mined, and production of calcined gypsum, 1939–43, by quarters.

Court trial of the civil action[1] by the United States Department of Justice against seven gypsum companies and officials on charges of violating sections 1, 2, and 3 of the Sherman Antitrust Act opened November 19. The civil action raises the broad question of legality under the Sherman Act of the defendants' alleged price-fixing practices under patent-licensing agreements.

Labor for gypsum operations was critical in 1943, and the War Manpower Commission certified the mining and processing of gypsum and the production of gypsum boards to the list of activities essential to the war. Average monthly employment in the gypsum products industry during 1943, according to the United States Department of Labor, was 92.0 percent of the corresponding figure for 1939. Considerable overtime was worked in 1943, as is indicated by an average monthly wage-earner pay-roll index of 151.5 compared with 100.0 in 1939.

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[1] Bureau of Mines Minerals Yearbook, 1942, p. 1286; 1941, p. 1293.

POST-WAR OUTLOOK

Although the outlook for the gypsum industry is not encouraging for the war's duration, post-war prospects are eminently favorable. Forecasts of residential building have unanimity in predicting large annual volumes for a period of years beginning immediately after removal of war restrictions on construction. Also, polls of public opinion reveal that the post-war demand will be predominantly for houses of the conventional type from which may be inferred continued use of the common pre-war structural materials. Gypsum products have prime advantages in the building field in that they are fire- and vermin-proof, will not warp, and are relatively low cost. In addition to the old-established line, two gypsum products—sheathing and laminated board—were accepted widely in war construction and apparently have bright futures in the post-war markets. New uses for industrial plasters, such as molds for metal casting and rubber products, forecast expanded consumption after the war. Demand for cement retarder and agricultural gypsum promises to be strong in the post-war period. All factors point toward brisk business for the gypsum industry after the war.

DOMESTIC PRODUCTION

Although output from domestic mines in 1943 virtually supplanted crude imports and represented 94 percent of the total new supply, domestic production fell 16 percent below 1942. Active operations totaled 56, comprising 26 underground mines, 24 open quarries, and 6 mine-quarry combinations. The average mill value of run-of-mine gypsum advanced to $1.54 per ton in 1943.

Crude gypsum mined in the United States, 1941–43, by States

State	1941			1942			1943		
	Active mines	Short tons	Value	Active mines	Short tons	Value	Active mines	Short tons	Value
California	7	381, 951	$618, 685	9	426, 670	$662, 181	6	455, 580	$622, 575
Iowa	8	630, 930	736, 185	7	514, 587	688, 211	6	418, 092	595, 602
Michigan	5	805, 861	1, 090, 309	6	891, 180	1, 286, 242	6	538, 602	737, 719
Nevada	4	284, 795	754, 294	5	330, 333	540, 579	4	347, 961	702, 906
New York	9	1, 080, 320	1, 500, 307	10	1, 012, 987	1, 605, 530	9	713, 961	1, 229, 796
Oklahoma	3	258, 258	344, 489	3	243, 545	321, 652	(1)	(1)	(1)
Texas	7	446, 419	467, 087	6	414, 196	496, 669	7	394, 841	519, 541
Utah	4	61, 813	78, 147	4	48, 574	60, 259	(1)	(1)	(1)
Other States [2]	13	838, 187	1, 204, 720	14	815, 496	1, 149, 857	18	1, 008, 504	1, 551, 476
	60	4, 788, 543	6, 794, 223	64	4, 697, 568	6, 811, 180	56	3, 877, 541	5, 959, 615

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[1] Included under "Other States."

[2] By groups of States as follows—1941: Arkansas (1 active mine) and Kansas (2)—174,918 tons valued at $177,499; Colorado (2), Montana (2), South Dakota (1), and Wyoming (1)—149,848 tons, $222,710; Ohio (2) and Virginia (2)—513,421 tons, $804,511. 1942: Arizona (1), Arkansas (1), and Kansas (2)—142,731 tons, $170,403; Colorado (2), Montana (2), South Dakota (1), and Wyoming (1)—135,588 tons, $202.612; Ohio (2) and Virginia (2)—537,177 tons, $776,842. 1943: Arkansas (1), Kansas (2), and Oklahoma (2)—371,893 tons, $501,203; Colorado (3), Montana (2), South Dakota (1), Utah (2), and Wyoming (1)—166,547 tons, $235,628; Ohio (2) and Virginia (2)—470,064 tons, $814,645.

CALCINED PRODUCTION AND PROCESSING EQUIPMENT

The calcined production in 1943 was obtained from 50 active plants distributed through 24 States. Active calcining equipment in these plants comprised 169 kettles, 8 beehive kilns, 11 rotary kilns, and 4 grinding-calcining units. The average mill value of calcined gypsum, which is a "transfer value" assigned by producers, increased 38 cents over 1942 to $5.77 per ton in 1943.

Calcined gypsum produced in the United States, 1942–43, by districts

District	1942		1943	
	Short tons	Value	Short tons	Value
New Hampshire, Vermont, Massachusetts, and Connecticut	91,788	$589,055	47,987	$358,391
Eastern New York, New Jersey, Pennsylvania, Georgia and Florida	500,011	3,390,693	183,993	1,366,383
Western New York	529,616	2,439,984	506,177	2,805,805
Ohio and Virginia	286,296	1,661,865	305,410	1,893,021
Michigan and Indiana	424,283	2,259,095	344,150	1,913,787
Iowa	324,387	1,476,107	286,855	1,435,268
Kansas and Oklahoma	159,585	853,532	191,643	1,194,097
Texas	285,430	1,202,266	275,920	1,273,305
Colorado, Wyoming, South Dakota, and Montana	73,893	446,562	88,527	584,004
Utah	20,695	122,303		
California, Nevada, and Arizona	349,098	1,961,606	327,068	1,927,526
	3,045,082	16,403,068	2,557,730	14,751,587

To meet the strong demand for board products, the 36 board machines in the country were operated at 78 percent of capacity in 1943 (capacity data are upon a time-utilized basis, in which 100 percent equals full operation for 85 percent of the total number of hours in each month). The monthly range in rate of operations was between 65 percent of capacity in January and 84 percent in June. Over-all activity of machines in Atlantic tidewater plants was well below that of machines in plants processing domestic crude. Activity of the 8 machines in Atlantic tidal plants was 49 percent of capacity and was lowest in March (39 percent) and highest in November (56 percent). The remaining 28 machines in plants not on Atlantic tidewater were operated at a monthly rate that averaged 90 percent of capacity and ranged between 86 percent in May and 94 percent in April and November. One machine in the Northeastern States was shut down early in 1943. In the board-shortage area on the Pacific coast, producers were unable to reach full capacity of machines because of the scarcity of surfacing papers in that region.

DISTRIBUTION OF SALES, BY USES

The second year of war effected further changes in the distribution of total sales value among groups of gypsum products. As illustrated in figure 2, the proportions represented by sales values of uncalcined products, building plasters (including Keene's cement), lath, and tile declined from the 1942 distribution, whereas the proportions for industrial plasters and "All other board" increased. The "All other board" group includes wallboard, sheathing, and laminated board and in 1943 represented 63 percent of the total sales value. Comparison of the 1941 and 1943 distributions shows the marked changes in composition of sales by the industry that have been caused by the war.

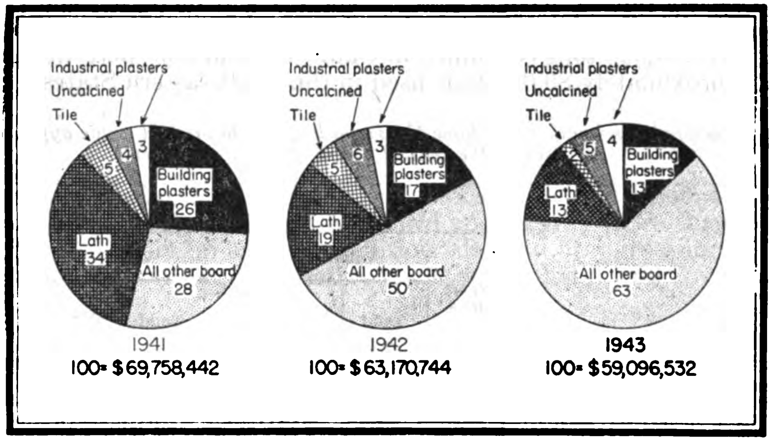

FIGURE 2.—Percentage distribution of total sales value, f. o. b. plant, of gypsum products, 1941–43, by groups of products.

A notable feature of figure 3 is the steep uptrend of the "wall- and other board" (includes wallboard, sheathing, and laminated board) curve since 1939 and the continuation of this trend through 1943 despite the slump in floor area of building. Although lath sales fell sharply in 1942 and 1943, the square footage sold in 1943 was only slightly lower than in 1929 and was far above the low point reached in 1933. The decline in total area of building in the country probably was not as severe as was indicated by the Dodge Corporation figures, which do not include construction west of the Rocky Mountains. In 1943, a larger than usual proportion of total building was in the Far West region.

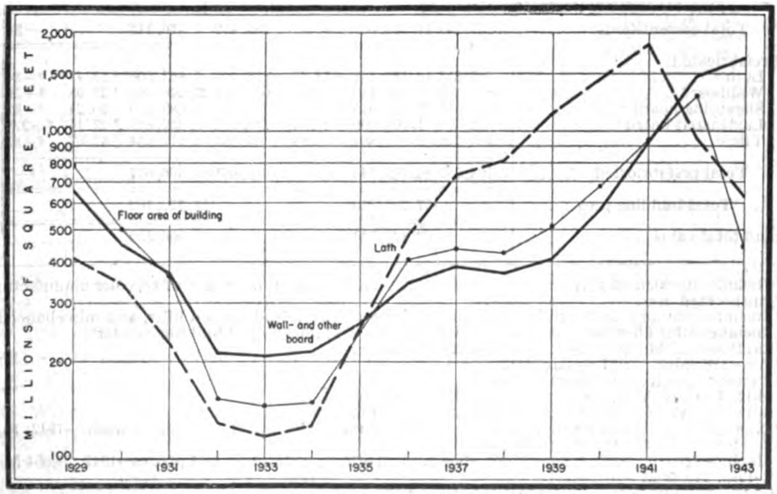

FIGURE 3.—Trends in sales of gypsum lath and wall- and other board (includes wallboard, laminated board in terms of component board, and sheathing) compared with Dodge Corporation figures on floor area of residential and nonresidential building, 1929–43.

Sales of agricultural gypsum in 1943 advanced to a record annual volume, but as this gain only partly offset the sharp decline in consumption of cement retarder the total sales of uncalcined products fell nearly one-fifth below 1942. The marked increase over 1942 in use of agricultural gypsum resulted from a 60-percent gain to approximately 293,000 tons consumed in California and a 30-percent increase to approximately 80,000 tons used in the Southeastern States.

Gypsum products (made from domestic, imported, and byproduct crude gypsum) sold or used in the United States, 1942–43, by uses

Use	1942			1943			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
Uncalcined:								
Portland-cement retarder	1, 245, 277	$2, 543, 272	$2. 04	835, 495	$1, 762, 414	$2. 11	−33	+3
Agricultural gypsum	251, 998	823, 645	3. 27	382, 346	1, 201, 704	3. 14	+52	−4
Other uses [1]	17, 638	166, 690	9. 45	15, 886	150, 671	9. 48	−10	------
Total uncalcined uses	1, 514, 913	3, 533, 607	------	1, 233, 727	3, 114, 789	------	−19	------
Industrial:								
Plate-glass and terra-cotta plasters	18, 096	119, 849	6. 62	20, 000	131, 441	6. 57	+1	−1
Pottery plasters	30, 856	423, 927	13. 74	34, 803	460, 374	13. 23	+13	−2
Orthopedic and dental plasters	14, 319	438, 375	30. 61	14, 764	388, 873	26. 34	+3	−14
Other industrial uses [2]	79, 434	858, 776	10. 81	93, 933	1, 278, 293	13. 61	+18	+26
Total industrial uses	142, 705	1, 840, 927	------	163, 500	2, 258, 981	------	+15	------
Building:								
Cementitious:								
Plasters:								
Base-coat	848, 280	7, 596, 058	8. 95	527, 596	4, 720, 209	8. 95	−38	------
Sanded	101, 497	638, 388	6. 29	72, 566	445, 948	6. 15	−29	−2
To mixing plants	17, 527	111, 348	6. 35	24, 851	112, 931	4. 54	+42	−28
Gauging and molding	105, 728	1, 279, 506	12. 10	74, 002	868, 091	11. 73	−30	−3
Prepared finishes	8, 990	348, 818	38. 80	4, 329	107, 135	24. 75	−52	−36
Insulating and roof-deck	48, 266	385, 102	7. 98	44, 643	342, 619	7. 67	−8	−4
Other [3]	12, 107	485, 980	40. 14	13, 456	593, 552	44. 11	+11	+10
Keene's cement	14, 848	238, 467	16. 06	8, 019	125, 630	15. 67	−46	−2
Total cementitious	1, 157, 243	11, 083. 667	------	769, 462	7, 316, 115	------	−34	------
Prefabricated:								
Lath [4]	717, 638	12, 116, 144	[5] 12. 63	475, 900	7, 863, 506	[5] 12. 47	[6] −34	[5] −1
Wallboard [7]	873, 302	23, 200, 410	[5] 22. 18	1, 027, 534	27, 296, 293	[5] 21. 98	[6] +19	[5] −1
Sheathing board [8]	374, 550	7, 016, 015	[5] 19. 00	237, 768	4, 683, 376	[5] 20. 24	[6] −37	[5] +7
Laminated board [9]	55, 676	1, 464, 090	[5] 27. 54	211, 105	5, 450, 818	[5] 27. 14	[6] +278	[5] −1
Tile [10]	143, 221	2, 915, 884	[11] 45. 81	66, 354	1, 112, 654	[11] 42. 67	[6] −53	[11] −7
Total prefabricated	2, 164, 387	46, 712, 543	------	2, 018, 661	46, 406, 647	------	[6] −7	------
Total building uses	--------	57, 796, 210	------	--------	53, 722, 762	------	------	------
Grand total value	--------	63, 170, 744	------	--------	59, 096, 532	------	------	------

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[1] Includes uncalcined gypsum sold for use as filler and rock dust, in brewer's fixe, color manufacture, and for unspecified uses.

[2] Includes statuary, industrial casting and molding plasters, dead-burned filler, and miscellaneous uses.

[3] Includes joint filler, patching and painter's plaster, and unclassified building plasters.

[4] 1942: 959,307 M square feet; 1943: 630,639 M square feet.

[5] Average value per M square feet.

[6] Percent of change in square footage.

[7] 1942: 1,046,025 M square feet; 1943: 1,241,828 M square feet.

[8] 1942: 369,313 M square feet; 1943: 231,356 M square feet.

[9] New product first marketed in 1942. Square footage in terms of component board—1942: 53,170 M square feet; 1943: 200,815 M square feet.

[10] Includes partition, roof, floor, soffit, shoe, and all other gypsum tiles and planks—1942: 24,664 M square feet; 1943: 11,638 M square feet.

[11] Average value per M square feet of partition tile only.

The aggregate tonnage of industrial plasters sold in 1943 advanced 15 percent over 1942, owing to gains of varying proportions in sales of all groups. The downtrend in consumption of the plate-glass and terra-cotta group which started in the fourth quarter of 1941 was interrupted for the first time in the fourth quarter of 1943, when the tonnage sold was sharply higher than in the same period of 1942. Sales of this group closely follow trends in plate-glass production.

Sales of all classifications of building plasters except the "To mixing plants" and "Other" groups fell markedly from the 1942 volumes, and the total tonnage of all cementitious gypsum materials declined 34 percent.

The sharp reduction from 1942 in indicated consumption of tiles resulted from slumps of nearly one-third and slightly more than two-thirds, respectively, in sales of partition tiles and of a grouping of all other tile shapes (roof, floor, soffit, plank, and others).

Gypsum board and tile sold or used in the United States, 1939–43, by types

Year	Lath			Wallboard		
	M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]
1939	1,137,415	$14,598,868	$12.84	405,655	$8,766,184	$21.61
1940	1,450,069	18,189,358	12.54	491,291	10,595,245	21.57
1941	1,843,648	23,524,812	12.76	757,588	16,578,698	21.88
1942	959,307	12,116,144	12.63	1,046,025	23,200,410	22.18
1943	630,639	7,863,506	12.47	1,241,828	27,296,293	21.98

Year	Sheathing			Laminated board [2]			Tile [3]		
	M square feet	Value		M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]		Total	Average [4]
1939	5,221	$105,649	$20.24	------	------	------	30,191	$2,066,086	$43.87
1940	89,631	1,632,688	18.22	------	------	------	30,026	1,962,963	45.58
1941	175,496	3,287,699	18.73	------	------	------	34,877	3,290,280	39.53
1942	369,313	7,016,015	19.00	[5] 53,170	$1,464,090	$27.54	24,664	2,915,884	45.81
1943	231,356	4,683,376	20.24	[5] 200,815	5,450,818	27.14	11,639	1,112,654	42.78

[1] Per M square feet, f. o. b. producing plant.
[2] New product first marketed in 1942.
[3] Includes partition, roof, floor, soffit, shoe, and all other gypsum tiles and planks.
[4] Per M square feet, f. o. b. producing plant, of partition tile only.
[5] Reported as area of component board and not of finished product.

PRICES

Prices of gypsum products in 1943, as indicated by the average mill values, showed a downward tendency. However, this easiness may have resulted from the absorption of the 3-percent transportation tax on sales in the Pacific coast region (except those under special rules of the Office of Price Administration) and in certain metropolitan areas where gypsum products are sold upon a delivered basis. The average plant value of agricultural gypsum was $2.25 in California, where sales were principally gypsite, and $6.28 in the Southeastern States, where rock and byproduct gypsum are used.

The following mill prices per M square feet of gypsum board products were set in Amendment 31 to Order A–1 under Maximum Price Regulation 188 for plants in Ohio, Michigan, Indiana, Iowa, Oklahoma, and Texas:

Lath	$13.00	Roof units (laminated), 1½-inch	$87.00
Wallboard, ¼-inch	20.00	Roof units (laminated), 2-inch	116.00
Wallboard, ⅜-inch	23.00	Sheathing (laminated), ¾-inch	44.00
Wallboard, ½-inch	25.00	Sheathing (laminated), 1-inch	48.00
Sheathing, ½-inch	20.00	Sheathing (weatherproof treated, laminated), 1-inch	53.00
Sheathing (weatherproof treated), ½-inch	22.50	Partition panel (laminated), 1-inch	58.00
Roof units (laminated), ¾-inch	54.00	Partition panel (laminated), 1½-inch	87.00
Roof units (laminated), 1-inch	58.00		

RECENT DEVELOPMENTS

The technical advantages and adaptability of the patented Capaco process as a means of precision casting of various nonferrous metals and alloys were described.[2] The process employs gypsum plaster as the mold material.

Use of a specially prepared gypsum product as an all-purpose desiccant has expanded markedly, and productive capacity[3] was quadrupled in 1943.

Description[4] of a new technique for the successful treatment of severe burns with plaster casts claims more rapid healing and return of motion to the injured part of the body than with other methods of treatment.

FOREIGN TRADE[5]

Virtually all of the crude gypsum imported during 1943 was from operations in Nova Scotia and New Brunswick, Canada. Slightly less than one-third of the tonnage was brought into the country during the first half of 1943, but with the easing of the shipping situation about midyear the rate of importation was accelerated, and the industry was permitted to import more than the quota set earlier in 1943. None of the Canadian crude entered ports farther south than the New York City customs district.

The small tonnage of crude from the Dominican Republic was consumed as cement retarder in Puerto Rico. As in former years, imports of gypsum products in 1943 were negligible.

Gypsum and gypsum products imported for consumption in the United States, 1939–43

Year	Crude (including anhydrite)		Ground		Calcined		Keene's cement		Alabaster manufactures[1]	Other manufactures, n. e. s.	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value			
1939	1,308,078	$1,174,117	1,475	$17,606	302	$6,551	4	$145	$110,136	$55,412	$1,363,967
1940	1,405,210	1,300,450	1,137	16,206	223	5,087	9	265	71,143	36,138	1,429,289
1941	1,347,957	1,225,152	1,631	30,499	242	6,416	34	945	3,232	15,896	1,282,140
1942	394,460	478,144	1,048	20,427	309	8,205	20	484	227	834	508,321
1943	231,323	275,503	958	18,902	73	1,950	16	392	1,064	6,259	304,070

[1] Includes imports of jet manufactures, which are reported to be negligible.

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[2] Hagemeyer, H. F., Plaster Molds for Precision Nonferrous Castings: Trans. Am. Foundrymen's Assoc., vol. 50, 1942, pp. 1155–1162.

[3] Chemical and Engineering News, vol. 2 , No. 2, January 25, 1944, p. 121.

[4] Levenson, Stanley M., and Lund, Charles C., The Treatment of Burns of the Extremities: Jour. Am. Med. Soc., vol. 123, No. 5, October 2, 1943, pp. 272–276.

[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Crude gypsum (including anhydrite) imported for consumption in the United States, 1941–43, by countries

Country	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	1, 345, 681	$1, 220, 761	391, 407	$469, 068	230, 429	$271, 755
China	2	88				
Dominican Republic			3, 053	9, 076	894	3, 748
Hong Kong	6	240				
United Kingdom [1]	2, 268	4, 063				
	1, 347, 957	1, 225, 152	394, 460	478, 144	231, 323	275, 503

[1] United Kingdom of Great Britain and Northern Ireland.

The only notable change in the export trade of 1943 was the slump in foreign shipments of gypsum board. As most of the board exports in recent years have been to the United Kingdom, the decline probably resulted from a shortage of shipping space. Demand for gypsum board to repair bombed buildings in the British Isles probably has not decreased in such marked degree as would be indicated by the data on exports from the United States.

Gypsum and gypsum products exported from the United States, 1939–43

Year	Crude, crushed, or ground		Plasterboard and wallboard		Calcined		Other manufactures, n. e. s.	Total value
	Short tons	Value	Square feet	Value	Short tons	Value		
1939	10, 342	$41, 012	5, 258, 249	$130, 073	2, 913	$69, 577	$68, 791	$309, 453
1940	5, 209	31, 564	4, 152, 452	101, 680	2, 208	56, 419	74, 465	264, 128
1941	15, 491	72, 877	13, 560, 482	296, 848	3, 041	90, 397	69, 452	529, 574
1942	595	14, 543	39, 489, 186	772, 989	1, 859	84, 784	105, 547	977, 863
1943	5, 300	22, 405	2, 953, 173	84, 163	2, 436	98, 229	78, 923	283, 720

WORLD PRODUCTION

World production of gypsum in 1943 is estimated at approximately 10 million metric tons, a slight gain over 1942. In the Western Hemisphere, the sharp declines in the outputs of the United States and Canada were offset in part by increased production in the Latin American countries, where construction was more active than in 1942. Production in European countries probably advanced over 1942 owing to increased demand for cement retarder and structural materials to repair or replace bombed buildings. Also, in England, France, and Germany the use of gypsum or anhydrite as raw material for making sulfuric acid and sulfide and sulfate chemicals doubtless gained over 1942 because of difficulties in obtaining supplies of sulfur and pyrites. The aggregate output from Asiatic countries and Australia probably increased slightly because of larger consumption as cement retarder. Total production in Africa apparently was about the same as in 1942; the declines in output from North African countries probably were compensated by gains in the South African region.

There has been a paucity of production data by countries since 1939 when war started in Europe. The only figures available for 1943 are: United States 3,517,628 metric tons, Canada 390,058 tons (sales), and Egypt 91,881 tons. Output in the United States represented approximately one-third of the world production, and is estimated to be about three times that of each of the next ranking countries—Germany and United Kingdom. Other countries with important output are, in probable order of tonnage, Spain, France, and Russia.

World production of gypsum, 1938–43, by countries, in metric tons[1]

[Compiled by B. B. Waldbauer]

Country[1]	1938	1939	1940	1941	1942	1943
Algeria	33,325	(2)	(2)	(2)	(2)	(2)
Anglo-Egyptian Sudan			(2)	(2)	(2)	(2)
Argentina[3]	70,813	97,328	103,157	133,848	(2)	(2)
Australia:						
New South Wales	12,712	(2)	(2)	(2)	(2)	(2)
South Australia	148,943	147,266	155,901	115,323	(2)	(2)
Victoria	13,596	11,966	(2)	(2)	(2)	(2)
Western Australia	13,645	14,570	13,020	(2)	(2)	(2)
Belgian Congo	1,000	(2)	500	(2)	(2)	(2)
Brazil[4]	2,000	2,000	2,000	(2)	(2)	(2)
Canada	983,435	1,390,183	1,397,778	1,415,600	723,137	[5] 390,058
Chile	24,551	22,209	25,865	23,125	(2)	(2)
China	(2)	(2)	75,000	(2)	(2)	(2)
Cuba	7,257	6,270	12,000	12,000	4,303	(2)
Cyprus	[6] 9,729	[6] 5,058	[4] 1,400	(2)	(2)	(2)
Egypt	212,088	700,166	169,723	130,942	118,931	91,881
Eire	13,364	16,168	21,662	24,660	(2)	(2)
Estonia	13,915	(2)	(2)	(2)	(2)	(2)
France	(2)	(2)	(2)	(2)	(2)	(2)
Germany	(2)	(2)	(2)	(2)	(2)	(2)
Austria[7]	(2)	(2)	(2)	(2)	(2)	(2)
Greece	16,609	15,219	(2)	(2)	(2)	(2)
India, British	70,944	69,786	(2)	(2)	(2)	(2)
Iraq		69,545	34,879	(2)	(2)	(2)
Italy	425,299	(2)	(2)	(2)	(2)	(2)
Latvia	220,000	245,035	(2)	(2)	(2)	(2)
Luxemburg	19,901	(2)	(2)	(2)	(2)	(2)
New Caledonia	1,070	(2)	3,000	(2)	(2)	(2)
Palestine	3,984	4,524	4,403	(2)	(2)	(2)
Peru	14,026	15,655	21,478	22,472	(2)	(2)
Portugal	9,036	(2)	(2)	(2)	(2)	(2)
Rumania	69,079	(2)	(2)	(2)	(2)	(2)
Sweden	95	102	(2)	(2)	(2)	(2)
Switzerland	35,000	38,000	30,000	(2)	(2)	(2)
Tunisia	(2)	(2)	(2)	(2)	(2)	(2)
Union of South Africa	38,849	40,782	46,202	(2)	(2)	(2)
United Kingdom	1,109,928	(2)	(2)	(2)	(2)	(2)
United States	2,435,057	2,927,231	3,355,672	4,344,062	4,261,540	3,517,628

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[1] In addition to the countries listed gypsum is produced in Chosen, Japan, French Morocco Mexico. Poland, Spain, U. S. S. R., and Yugoslavia, but production data are not available.

[2] Data not available.

[3] Rail and river shipments.

[4] Approximate production.

[5] Sales.

[6] Exports of crude and calcined gypsum.

[7] Estimate furnished by Bundesministerium für Handel und Verkehr.

LIME

By Forrest T. Moyer and F. D. Gradijan

SUMMARY OUTLINE

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SUMMARY

The over-all demand for lime increased in 1943 as the country passed from the construction into the production phase of the war program. Total sales of "open-market" lime advanced to 6,596,615 short tons, a new annual record that exceeded the former high set in 1942 by 8 percent. However, not all branches of the industry participated in the increased activity. Sales of agricultural, chemical, and refractory (dead-burned dolomite) lime gained over the 1942 tonnages, but sales of building lime were appreciably lower than in 1942. Demand for quicklime increased substantially, whereas that for hydrated lime rose only slightly in 1943. The war has had a marked effect on sales of the two types of lime, and in 1943 the tonnage of hydrate sold represented only 20 percent of the total compared with 26 percent in 1941, the last year of peacetime conditions. Government regulation of the selling prices of lime continued throughout 1943. Maximum prices of refractory lime were unchanged, and only a few upward adjustments for individual producers were allowed for agricultural, building, and chemical lime. The net mill realization advanced 17 cents over 1942 to $7.44 per ton in 1943.

Lime producers in all sections of the country reported operating difficulties, of which the most prevalent were short labor supply, high rate of labor turn-over, rising production costs, and low prices. The extreme shortage of labor was indicated by Bureau of Labor Statistics indexes of average monthly employment at lime plants, which were 98.7 in 1943 compared with 100 in 1939 when production was 36 percent lower than in 1943. The high turn-over rate doubtless left many lime plants with inexperienced and hence relatively inefficient labor forces. Owing to overtime rates of pay and some reported increases in basic wage rates, labor costs probably were the principal factor in the increased production costs. The rise in labor costs may be measured by the pay-roll indexes of the Bureau of Labor Statistics, which had a monthly average of 171.6 for the lime industry in 1943 in contrast with 100 in 1939. Other contributing elements were increased costs of fuels, materials, and repairs. The combination of the foregoing factors and the squeeze on producers between rising production costs and relatively rigid ceiling prices resulted in the closing of numerous plants, mostly of small capacity, in 1943. Offsetting this temporary loss of industry capacity, five portland-cement plants were converted in part in 1943 to the calcining of lime, and at a sixth it was planned to start production early in 1944.

Total demand for chemical lime gained sharply in 1943 as a result of the completion and start of production in many new war plants with large requirements for lime. Consumption of chemical lime by the various industries continued to show diverse effects of the war, and although the total increased in 1943 consumption in many of the chemical uses declined from 1942. However, most of the decreased requirements were in industries with relatively small consumption, whereas nearly all industries with large requirements—notably metallurgical, carbide, glass, insecticides, and water purification—purchased more lime in 1943. In some areas of the country, local supplies could not satisfy the demand, and chemical lime had to be shipped in from relatively distant plants.

Salient statistics of the lime industry in the United States, 1925–29 (average), 1935–39 (average), and 1941–43

	1925–29 (average)	1935–39 (average)	1941	1942	1943
Active plants	419	310	309	270	245
Sold by producers:					
By types:					
Quicklime……short tons	2,871,236	2,488,269	4,489,257	4,810,452	5,283,227
Hydrated……do	1,585,631	1,204,128	1,590,159	1,293,339	1,313,388
Total lime:					
Short tons	4,456,867	3,692,397	6,079,416	6,103,791	6,596,615
Value [1]	$38,548,498	$26,592,115	$42,941,162	$44,367,441	$49,064,328
Per ton	$8.65	$7.20	$7.06	$7.27	$7.44
By uses:					
Agricultural……short tons	318,224	350,535	382,727	400,631	454,133
Building……do	2,096,744	870,335	1,065,599	697,677	557,958
Chemical and industrial……do	1,623,885	1,929,947	3,561,203	3,776,126	4,307,799
Refractory (dead-burned dolomite) short tons	418,014	541,580	1,069,887	1,229,357	1,276,725
Imported for consumption:					
Short tons	18,683	14,108	12,619	8,501	(2)
Value	$344,887	$240,909	$109,608	$84,875	(2)
Exported:					
Short tons	15,752	10,905	46,500	36,061	(2)
Value	$221,177	$123,167	$475,540	$400,845	(2)

[1] Selling value, f. o. b. plant, excluding cost of containers.
[2] Data not available.

The 21-percent increase in sales of metallurgical lime in 1943 over the prior record volume of 1942 resulted from the high rate of operations of the enlarged open-hearth and electric-furnace capacities of the steel industry, greatly increased consumption in Bayer alumina and magnesium plants, and the larger tonnages of metallic ores treated by flotation in 1943. Although only two magnesium metal plants use "open-market" lime, several others purchased their lime requirements early in 1943, as the processing sections of the plants were completed before the lime-calcining equipment was in place. The 75-percent gain in sales of lime for carbide manufacture was the largest proportional increase of any of the major chemical uses and resulted principally from full operation of several war plants that buy their lime supplies. Demand for lime in glass manufacture, preparation of insecticides and disinfectants, and water purification also advanced appreciably in 1943. The only major chemical uses of lime to show decreased consumption from 1942 were in the paper and tanning industries.

Sales of refractory lime (dead-burned dolomite) in 1943 advanced slightly over 1942 to set a new high annual quantity. This gain apparently resulted in part from increased use of dead-burned dolomite as a patching material in open-hearth and electric furnaces, which was indicated by the moderate decline in consumption of raw dolomite for refractory uses, as listed in the Stone chapter. The increased output of steel in 1943 also contributed to the gain in demand for refractory lime.

War restrictions on construction and the changes in types of materials used in wartime compared with peacetime building were the basic causes of the continued slump in sales of building lime. The decline from 1942 in demand for mason's lime was less severe than for finishing lime, owing to the moderate use of masonry walls in war construction because of the growing critical shortage of building lumber in 1943. Sales of finishing lime were nearly a third lower than in 1942, because prefabricated, finished materials continued to replace the "built-in" construction in war housing.

Sales of agricultural lime were 13 percent larger than in 1942—a relatively small increase compared with the 23-percent gain in cash farm income. Demand in 1943 for agricultural quicklime was unchanged from 1942, whereas that for agricultural hydrate gained one-fourth over the 1942 tonnage.

The principal war controls on the lime industry in 1943 were the price regulations of the Office of Price Administration. The permitted maximum prices on building and chemical lime were continued throughout 1943 at the March 1942 level set in Maximum Price Regulation 188. A method of adjusting ceiling prices for individual producers in cases of general shortages of lime was provided in Order A–2 of the regulation, and a few price increases were allowed after the order became effective on July 5, 1943. Prices for agricultural lime were controlled by the General Maximum Price Regulation until May 15, 1943, when it was placed under Maximum Price Regulation 386. The latter order provided three methods for computing maximum prices, and a small number of upward adjustments were permitted after the effective date of the order. Control of prices of dead-burned dolomite was removed from Maximum Price Regulation 188 and placed under Maximum Price Regulation 416, which became effective July 3, 1943. The new order set plant base prices for bulk shipments ranging from $9.30 to $9.50 per short ton and for shipments in heavy paper bags at $15 per ton.

War Production Board Conservation Order L–41, which directly affects sales of building lime through its limitations on construction, was amended several times, and the major revisions of November 1, 1943, and April 19, 1944, were somewhat more restrictive than the earlier forms.

Consumption of "open-market" lime in each of the regions of the United States has had nearly similar trends since 1928, as illustrated in figure 1. In 1943, the Middle States region had the largest consumption, although the quantity was only slightly higher than in

1942. Consumption in the Northeastern States declined slightly from 1942, but in the southern and western parts of the country it gained sharply. States included in the regions of figure 1 were selected with consideration to areas of lime consumption and other economic and geographic factors and are as follows: Northeastern—Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Southern—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; Middle—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; Rocky Mountain and Pacific—Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

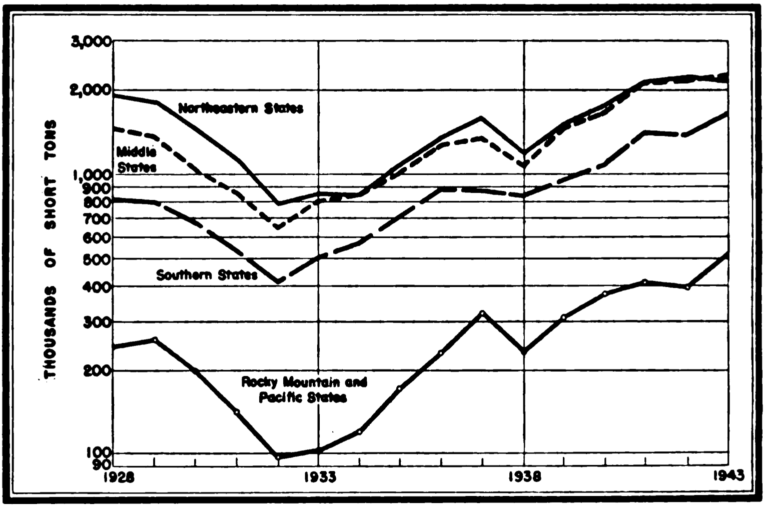

FIGURE 1.—Trends of indicated consumption of lime (including dead-burned dolomite) in the United States, 1928–43, by regions.

POST-WAR OUTLOOK

The outlook for "open-market" lime in the post-war period is encouraging, owing to some newly developed or greatly expanded uses and to increased sales to process industries that will be meeting an expectedly large backlog of civilian demand. Steel, the largest consuming industry, doubtless will require more lime for flux and refractory purposes than in the pre-war period; however, the annual requirements will be appreciably lower than during wartime. A similar situation prevails with regard to lime for carbide and alumina manufacture. The new uses in production of magnesia from sea water and of magnesium by the ferrosilicon process will have only slight upward effects, as most of the lime used in these industries falls into the captive classification. Lime requirements of the paper, glass, insecticide, water-treatment, and tanning industries doubtless will be high in the post-war era. Growing recognition of the importance of lime as a plant food and the easier availability of supplies through reopening of the many small lime plants shut down for the war should result in moderately increased consumption for agricultural purposes. The large volume of deferred construction, expected when war restrictions are removed, doubtless will raise sales of building lime well above the pre-war tonnages. All factors point toward at least a moderate gain in demand for "open market" lime over the pre-war levels.

PRODUCTION

Production of lime for each of the major uses, except building, advanced over the 1942 tonnages. Stocks reportedly are small, so that in this chapter sales are considered equivalent to production of "open-market" lime.

Lime sold by producers in the United States, 1942–43, by types and major uses

	1942				1943					
	Quantity		Value [1]		Quantity		Value [1]		Percent of change in—	
	Short tons	Per-cent of total	Total	Aver-age	Short tons	Per-cent of total	Total	Aver-age	Ton-nage	Aver-age value
By types:										
Quicklime	4,810,452	79	$34,077,137	$7.08	5,283,227	80	$38,617,278	$7.31	+10	+3
Hydrated lime	1,293,339	21	10,290,304	7.96	1,313,388	20	10,447,050	7.95	+2	......
Total lime [2]	6.103,791	100	44,367,441	7.27	6,596,615	100	49,064,328	7.44	+8	+2
By uses:										
Agricultural:										
Quicklime	184,678	3	950,374	5.15	184,028	3	1,092,898	5.94	......	+15
Hydrated lime	215,953	4	1,568,579	7.26	270,105	4	2,041,763	7.56	+25	+4
	400,631	7	2,518,953	6.29	454,133	7	3,134,661	6.90	+13	+10
Building:										
Quicklime	175,643	3	1,644,316	9.36	129,139	2	1,169,167	9.05	−26	−3
Hydrated lime	522,034	8	4.528,889	8.68	428,819	7	3,685,103	8.59	−18	−1
	697,677	11	6,173,205	8.85	557,958	9	4,854,270	8.70	−20	−2
Chemical and industrial:										
Quicklime	3,220,774	53	20,664,813	6.42	3,693,335	56	25,112,196	6.80	+15	+6
Hydrated lime	555,352	9	4,192,836	7.55	614,464	9	4,720,184	7.68	+11	+2
	3,776,126	62	24,857,649	6.58	4,307,799	65	29,832,380	6.93	+14	+5
Refractory (dead-burned dolomite)	1,229,357	20	10,817,634	8.80	1,276,725	19	11,243,017	8.81	+4	......

[1] Selling value, f. o. b. plant, excluding cost of containers.

[2] Includes lime used by producers (captive tonnage) as follows—1942: 427,835 short tons valued at $2,239,152; 1943: 434,571 tons, $2,457,795.

Captive tonnage.—The captive tonnage included in the figures on "open market" lime in 1943 totaled 434,571 short tons valued at $2,457,795. This total comprised 8,353 tons for masonry mortars, 325,517 tons for metallurgical uses (slightly more than half for ore concentration and the remainder for steel flux), 12,636 tons for minor chemical uses, and 88,065 tons of refractory lime.

PRODUCTION, BY STATES

The effects of the war on the location of lime production, noted in 1942, were more pronounced in 1943. The record output of 1943 was obtained from 245 plants in 36 States and 2 Territories. Compared with 1942, production gained in 19 States, declined in 14 States and 2 Territories, and was relatively unchanged in 3 States. No lime was produced in Rhode Island in 1943.

Lime sold by producers in the United States, 1942–43, by States

State or Territory	1942			1943		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	9	330, 552	$1, 916, 985	8	331, 182	$1, 959, 266
Arizona	4	59, 033	439, 817	3	71, 044	556, 345
Arkansas	2	(1)	(1)	2	(1)	(1)
California	9	83, 399	905, 923	9	168, 502	1, 749, 668
Colorado	3	(1)	(1)	3	(1)	(1)
Connecticut	1	(1)	(1)	1	(1)	(1)
Florida	4	21, 510	212, 291	4	20, 507	202, 276
Georgia	1	10, 824	68, 323	1	8, 513	59, 514
Hawaii	1	8, 863	140, 762	1	7, 633	123, 172
Illinois	9	314, 078	2, 269, 743	8	314, 736	2, 386, 554
Indiana	3	102, 757	608, 656	3	(1)	(1)
Louisiana	1	(1)	(1)	1	(1)	(1)
Maine	2	(1)	(1)	2	(1)	(1)
Maryland	11	62, 871	371, 189	10	78, 386	530, 989
Massachusetts	6	87, 537	757, 109	5	94, 877	783, 999
Michigan	5	58, 283	420, 523	5	96, 554	717, 401
Minnesota	2	(1)	(1)	1	(1)	(1)
Missouri	10	853, 020	4, 915, 784	11	963, 301	6, 046, 453
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	2	(1)	(1)	2	(1)	(1)
New Jersey	3	(1)	(1)	3	(1)	(1)
New Mexico	1	(1)	(1)	1	(1)	(1)
New York	4	68, 443	552, 411	5	121, 890	976, 692
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	23	1, 418, 161	11, 739, 547	21	1, 469, 654	12, 001, 684
Oklahoma	3	(1)	(1)	3	(1)	(1)
Oregon	1	(1)	(1)	1	(1)	(1)
Pennsylvania	62	1, 030, 156	7, 708, 095	51	1, 021, 215	7, 864, 323
Puerto Rico	7	10, 178	162, 796	6	8, 153	168, 552
Rhode Island	1	(1)	(1)	----------	----------	----------
South Dakota	2	(1)	(1)	1	(1)	(1)
Tennessee	10	269, 566	1, 620, 585	9	235, 854	1, 503, 850
Texas	8	67, 377	559, 279	8	132, 167	1, 034, 355
Utah	6	57, 609	392, 912	5	59, 811	407, 753
Vermont	5	71, 642	462, 908	5	51, 011	357, 265
Virginia	25	206, 420	1, 367, 043	22	194, 974	1, 338, 675
Washington	3	55, 864	623, 766	2	(1)	(1)
West Virginia	8	422, 481	2, 879, 509	8	492, 292	3, 401, 706
Wisconsin	10	63, 801	499, 279	11	82, 913	633, 399
Undistributed [2]	----------	369, 366	2, 772, 206	----------	571, 446	4, 260, 437
	270	6, 103, 791	44, 367, 441	245	6, 596, 615	49, 064, 328

[1] Included under "Undistributed."

[2] By groups of States as follows: 1942: Maine, Rhode Island, Connecticut, and New Jersey, 77,039 short tons valued at $601,068; North Carolina, Louisiana, Arkansas, and Oklahoma, 102,282 tons, $802,873; Minnesota and South Dakota, 64,963 tons, $495,562; Colorado, New Mexico, Montana, Nevada, and Oregon, 125,082 tons, $872,703. 1943: Maine, Connecticut, and New Jersey, 65,168 tons, $471,864; North Carolina, Louisiana, Arkansas, and Oklahoma, 155,688 tons, $1,127,463; Indiana, Minnesota, and South Dakota, 162,961 tons, $1,095,697; Colorado, New Mexico, Montana, Nevada, Oregon, and Washington, 187,629 tons, $1,565,413.

Lime sold by producers in the United States in 1943, by States and uses

State or Territory	Agricultural		Building		Chemical and industrial										Refractory		Total	
					Metallurgical		Paper mills		Tanneries		Water purification		Other					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	37,013	$246,534	169,762	$916,683	78,911	$470,247	(1)	(1)	9,248	$79,441	(1)	(1)	(1)	(1)	331,182	$1,959,266
Arizona	(1)	(1)	(1)	(1)	63,963	469,026	----	----	----	----	(1)	(1)	(1)	(1)	----	----	71,044	556,345
Arkansas	----	----	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
California	(1)	(1)	26,159	324,979	83,398	768,782	6,831	67,382	1,191	$17,240	8,496	80,446	36,600	$442,204	(1)	(1)	168,502	1,749,668
Colorado	(1)	(1)	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	----	----	----	----	----	----	(1)	(1)
Florida	(1)	(1)	1,105	9,674	----	----	----	----	----	----	8,072	79,609	(1)	(1)	----	----	20,507	202,276
Georgia	964	$4,525	7,549	54,989	----	----	----	----	----	----	----	----	----	----	----	----	8,513	59,514
Hawaii	----	----	891	15,300	----	----	----	----	----	----	----	----	6,742	107,872	----	----	7,633	123,172
Illinois	(1)	(1)	7,090	78,603	146,950	975,485	8,395	54,434	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	314,736	2,386,554
Indiana	(1)	(1)	4,194	28,627	(1)	(1)	11,457	69,841	(1)	(1)	11,863	74,058	45,903	272,915	----	----	(1)	(1)
Louisiana	----	----	(1)	(1)	----	----	----	----	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Maine	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Maryland	64,157	440,582	(1)	(1)	(1)	(1)	----	----	----	----	----	----	(1)	(1)	----	----	78,386	530,989
Massachusetts	12,017	85,413	25,938	248,726	5,805	48,704	17,230	140,172	10,335	82,650	3,400	26,715	20,152	151,610	----	----	94,877	783,999
Michigan	(1)	(1)	----	----	9,579	72,435	(1)	(1)	(1)	(1)	(1)	(1)	40,024	294,951	----	----	96,554	717,401
Minnesota	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Missouri	----	----	38,811	264,596	258,367	1,617,786	(1)	(1)	(1)	(1)	77,753	494,467	460,272	2,666,142	(1)	(1)	963,301	6,046,453
Montana	----	----	(1)	(1)	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	----	----	(1)	(1)
Nevada	(1)	(1)	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
New Jersey	(1)	(1)	(1)	(1)	----	----	----	----	----	----	----	----	(1)	(1)	----	----	(1)	(1)
New Mexico	----	----	(1)	(1)	----	----	----	----	----	----	----	----	----	----	----	----	(1)	(1)
New York	4,153	32,707	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	51,734	406,496	----	----	121,890	976,692
North Carolina	(1)	(1)	(1)	(1)	----	----	----	----	----	----	----	----	----	----	----	----	(1)	(1)
Ohio	72,760	497,545	230,243	1,916,566	152,461	990,724	28,764	173,364	----	----	(1)	(1)	(1)	(1)	727,772	$6,572,841	1,469,654	12,001,684
Oklahoma	----	----	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Oregon	----	----	(1)	(1)	----	----	----	----	----	----	----	----	----	----	----	----	(1)	(1)
Pennsylvania	183,309	1,371,625	46,488	399,558	314,233	2,276,354	64,580	470,592	(1)	(1)	49,134	400,119	(1)	(1)	(1)	(1)	1,021,215	7,864,323
Puerto Rico	(1)	(1)	4,577	107,668	----	----	----	----	----	----	(1)	(1)	3,467	58,979	----	----	8,153	168,552
South Dakota	----	----	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	----	----	----	----	(1)	(1)
Tennessee	(1)	(1)	15,282	122,064	51,702	328,126	86,941	515,932	(1)	(1)	22,498	145,201	52,449	338,794	----	----	235,854	1,503,850
Texas	(1)	(1)	21,262	196,107	65,491	468,165	7,353	45,830	----	----	25,592	215,352	(1)	(1)	----	----	132,167	1,034,355
Utah	----	----	5,553	66,657	52,188	311,729	----	----	----	----	(1)	(1)	(1)	(1)	----	----	59,811	407,753
Vermont	(1)	(1)	(1)	(1)	(1)	(1)	15,811	132,323	(1)	(1)	(1)	(1)	10,879	95,066	----	----	51,011	357,265
Virginia	37,099	273,774	8,384	59,676	53,978	359,140	14,116	97,041	1,000	6,247	28,373	202,673	52,024	340,124	----	----	194,974	1,338,675
Washington	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
West Virginia	27,679	131,709	4,322	26,709	228,738	1,509,357	(1)	(1)	(1)	(1)	5,610	35,995	(1)	(1)	(1)	(1)	492,292	3,401,706
Wisconsin	3,366	21,954	12,624	112,805	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	82,913	633,399
Undistributed [2]	48,629	274,827	60,473	574,432	243,850	1,761,498	202,946	1,516,344	56,696	402,859	145,791	1,062,933	618,698	4,623,717	548,953	4,670,176	571,446	4,260,437
	454,133	3,134,661	557,958	4,854,270	1,900,468	12,873,994	543,335	3,753,502	69,222	509,005	395,830	2,897,009	1,398,944	9,798,870	1,276,725	11,243,017	6,596,615	49,064,328

[1] Included under "Undistributed."

[2] Includes items entered as "(1)."

Lime sold by producers in the United States, 1942–43, by uses

Use	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	400,631	$2,518,953	$6.29	454,133	$3,134,661	$6.90
Building:						
Finishing lime	281,227	2,688,734	9.56	191,425	1,790,001	9.35
Mason's lime	295,037	2,536,952	8.60	267,092	2,234,494	8.37
Prepared masonry mortars	51,303	362,745	7.07	35,174	244,806	6.96
Unspecified	70,110	584,774	8.34	64,267	584,969	9.10
	697,677	6,173,205	8.85	557,958	4,854,270	8.70
Chemical and industrial:						
Acid neutralization	5,181	30,124	5.81	17,763	131,262	7.39
Alkalies (ammonium, potassium, and sodium compounds)	7,336	51,198	6.98	8,011	57,360	7.16
Asphalts and other bitumens	706	5,592	7.92	1,547	13,080	8.46
Bleach, liquid and powder [1]	13,161	97,810	7.43	11,620	86,891	7.48
Brick, sand-lime and slag	20,550	166,779	8.12	5,979	50,217	8.40
Brick, silica (refractory)	17,507	135,537	7.74	15,204	127,395	8.38
Calcium carbide and cyanamide	202,518	1,114,447	5.50	355,092	2,297,924	6.47
Chromates and bichromates	20,538	130,902	6.37	22,969	149,342	6.50
Coke and gas (gas purification and plant byproducts)	17,629	112,355	6.37	30,545	212,126	6.94
Explosives	(2)	(2)	(2)	10,093	73,959	7.33
Food products:						
Creameries and dairies	1,427	19,721	13.82	3,667	34,156	9.31
Gelatin	7,223	56,083	7.76	5,277	39,416	7.47
Other [3]	8,952	80,852	9.03	4,534	54,585	12.04
Glassworks	190,580	1,402,674	7.36	208,166	1,534,777	7.37
Glue	7,886	52,224	6.62	9,463	82,248	8.69
Grease, lubricating	4,996	43,309	8.67	7,391	48,725	6.59
Insecticides, fungicides, and disinfectants	66,332	507,730	7.65	75,125	616,410	8.21
Magnesia (85 percent)	24,635	166,663	6.77	33,094	261,308	7.90
Medicines and drugs	6,021	35,479	5.89	4,922	30,524	6.20
Metallurgy:						
Nonferrous smelter flux	3,956	39,842	10.07	9,195	63,050	6.86
Steel (open-hearth and electric furnace flux)	1,171,082	7,508,445	6.41	1,174,654	7,840,972	6.68
Ore concentration [4]	318,436	1,942,098	6.10	680,343	4,693,911	6.90
Wire drawing	9,065	70,274	7.75	10,395	97,361	9.37
Other [5]	74,058	529,664	7.15	25,881	178,700	6.90
Paints	14,281	107,429	7.52	8,420	67,762	8.05
Paper mills [6]	606,440	4,049,884	6.68	543,335	3,753,502	6.91
Petroleum refining	30,944	267,120	8.63	28,729	253,584	8.83
Polishing compounds	758	20,836	27.49	(2)	(2)	(2)
Rubber manufacture	1,381	10,049	7.28	2,039	15,302	7.50
Salt refining	4,113	25,604	6.23	4,648	29,919	6.44
Sewage and trade-wastes treatment	25,758	177,651	6.90	17,660	126,448	7.16
Soap and fat	6,673	34,676	5.20	5,745	34,188	5.95
Sugar refining	27,655	315,127	11.39	21,106	256,161	12.14
Tanneries	78,746	549,828	6.98	69,222	509,005	7.35
Textiles	871	7,352	8.44	496	3,944	7.95
Tobacco	6,858	38,865	5.67	(2)	(2)	(2)
Varnish	311	2,689	8.65	230	1,987	8.64
Water purification	335,877	2,327,177	6.93	395,830	2,897,009	7.32
Wood distillation	2,901	28,622	9.87	1,848	16,499	8.93
Undistributed [7]	31,709	221,665	6.99	18,345	135,671	7.40
Unspecified	401,075	2,373,273	5.92	459,216	2,955,700	6.44
	3,776,126	24,857,649	6.58	4,307,799	29,832,380	6.93
Refractory lime (dead-burned dolomite)	1,229,357	10,817,634	8.80	1,276,725	11,243,017	8.81
Total lime [8]	6,103,791	44,367,441	7.27	6,596,615	49,064,328	7.44
Hydrated lime included in above distribution	1,293,339	10,290,304	7.96	1,313,388	10,447,050	7.95

[1] Excludes bleach used in paper mills.

[2] Included under "Undistributed."

[3] Includes chocolate, cocoa, fruit juices, phosphate baking powders, and unspecified food products.

[4] Includes flotation, cyanidation, bauxite purification, and magnesium manufacture.

[5] Includes mold coating and unspecified.

[6] Includes bleach used in paper mills.

[7] Includes alcohol, bromine, calcium carbonate (precipitated), cement manufacture, chloropicrin, dicalcium phosphate, glycerin, nicotine, photographic supplies, retarder, rock wool, starfish control, sulfur, and wool pullers.

[8] Includes lime used by producers (captive tonnage) as follows—1942: 427,635 short tons, valued at $2,239,152; 1943: 434,571 tons, $2,457,795.

PRODUCTION, BY USES

Production of lime for its varied uses in 1943 showed considerable deviation from the usual peacetime pattern, and although there was an over-all gain above 1942, declines were numerous for uses in industries related closely to civilian demand.

Lime and other liming materials used in agriculture.—The total effective lime content of all agricultural liming materials sold in 1943 increased 6 percent over 1942 owing to the program carried out under the War Foods Campaign. Indicated consumption of hydrated lime, crushed oystershells, and limestone (agstone) advanced over 1942, whereas that for quicklime was unchanged, and for marl it declined.

Agricultural lime and other liming materials sold by producers in the United States, 1942–43 by kinds

Kind	1942				1943			
	Short tons		Value		Short tons		Value	
	Gross	Effective lime content [1]	Total	Average	Gross	Effective lime content [1]	Total	Average
Lime:								
Quicklime	184,678	156,980	$950,374	$5.15	184,028	156,420	$1,092,898	$5.94
Hydrated lime	215,953	151,170	1,568,579	7.26	270,105	189,070	2,041,763	7.56
Oystershells (crushed) [2]	108,630	51,060	456,247	4.20	[3] 125,076	[3] 58,790	[3] 694,616	[3] 5.55
Limestone	13,745,400	6,460,340	16,993,254	1.24	14,521,670	6,825,190	19,057,120	1.31
Calcareous marl	194,878	81,850	135,046	.69	147,153	61,800	152,821	1.04

[1] Effective lime contents as follows: Quicklime, 85 percent; hydrated lime, 70 percent; limestone and oystershells, 47 percent; calcareous marl, 42 percent.

[2] Figures supplied by Fish and Wildlife Service.

[3] Preliminary figure.

Building lime.—The output of building lime continued to slump because of the strict curtailment of construction; the total produced in 1943 was only slightly higher than in 1934, the low point for building lime in the depression of the 1930's. Production of all classes of building lime declined in 1943.

Chemical and industrial lime.—Metallurgical industries, which were unusually active in 1943, required 29 percent of the total lime output. Sales of lime for paper making, the second largest use in 1943, declined 10 percent from 1942 because of the decreased activity in that industry owing to the pulpwood shortage. The greatly expanded use of acetylene gas for welding and synthetic rubber resulted in a 75-percent gain in sales of "open market" lime for carbide manufacture in 1943.

HYDRATED LIME

Production of hydrated lime in 1943 represented 20 percent of the total output compared with 21 percent in 1942 and 26 percent in 1941, the last year of peacetime conditions. One hundred sixty-five plants in 35 States and 2 Territories were active in 1943, and production gained over 1942 in 19 States, declined in 11 States and 2 Territories, and was virtually unchanged in 5 States.

Hydrated lime sold by producers in the United States, 1942–43, by States

State or Territory	1942			1943		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	8	25, 575	$209, 270	6	32, 659	$282, 040
California	8	30, 367	333, 578	7	35, 871	441, 121
Florida	4	11, 295	120. 044	3	7, 279	75, 531
Georgia	1	7, 420	52, 810	1	7, 549	54, 989
Hawaii	1	8, 823	138, 962	1	7, 597	121, 552
Illinois	6	31, 366	234, 242	4	31, 451	239, 452
Indiana	3	21, 419	145, 486	(1)	(1)	(1)
Maryland	5	28, 767	181, 602	5	34, 880	234, 981
Massachusetts	5	41, 154	322, 626	5	48, 642	383, 969
Michigan	3	7, 835	59, 762	3	6, 154	56, 463
Missouri	9	184, 866	1, 134, 640	9	190, 757	1, 239, 035
New York	3	17, 686	132, 596	3	14, 441	113, 043
Ohio	16	356, 265	2, 979, 928	16	334, 884	2, 638, 572
Pennsylvania	19	213, 475	1, 744, 061	17	234, 664	1, 913, 436
Puerto Rico	4	5, 248	81, 557	3	4, 401	100, 600
Tennessee	8	42, 434	322, 088	8	46, 366	366, 966
Texas	6	23, 355	225, 039	5	32, 308	304, 244
Virginia	16	62, 453	443, 049	14	57, 501	414, 767
West Virginia	5	34, 473	213, 452	5	34, 657	217, 301
Other States [2]	35	139, 063	1, 215, 512	34	151, 327	1, 248, 988
	165	1, 293, 339	10, 290, 304	149	1, 313, 388	10, 447, 050

[1] Included under "Other States."

[2] By groups of States as follows—1942: Maine (2 active plants), Vermont (2), Rhode Island (1), Connecticut (1), and New Jersey (3), 53,086 short tons, valued at $381,529; North Carolina (1), Louisiana (1), Arkansas (2), and Oklahoma (3), 31,374 tons, $294,885; Wisconsin (7), and Minnesota (2), 22,776 tons, $173,587; Colorado (1), Utah (2), and Arizona (2), 12,130 tons, $157,508; and Nevada (1), Montana (1), Washington (2), and Oregon (1), 19,697 tons, $208,003. 1943: Maine (2), Vermont (2), Connecticut (1), and New Jersey (3), 46,672 tons, $310,770; North Carolina (1), Louisiana (1), Arkansas (2), and Oklahoma (1), 22,917 tons, $182,324; Indiana (3), Wisconsin (6), Minnesota (1), South Dakota (1), Colorado (1), Utah (2), and Arizona (2), 59,600 tons, $507,802; and Nevada (1), Montana (1), Washington (2), and Oregon (1), 22,138 tons, $248.092.

Uses.—The decreased demand from 1942 for hydrate used in building and paper making was more than compensated for by the increased output for agricultural, metallurgical, insecticide, and water-purification uses.

Hydrated lime sold by producers in the United States, 1942–43, by uses

Use	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	215, 953	$1, 568, 579	$7. 26	270. 105	$2, 041, 763	$7. 56
Building	522, 034	4, 528, 889	8. 68	428, 819	3, 685, 108	8. 59
Chemical and industrial:						
Brick, sand-lime, and slag	4, 220	35, 158	8. 33	(1)	(1)	(1)
Brick, silica	9, 368	78, 608	8. 39	12, 359	106, 973	8. 66
Coke and gas	(1)	(1)	(1)	2, 827	24, 964	8. 83
Food products	10, 133	94, 663	9. 34	8, 742	86, 657	9. 91
Glass	3, 869	27, 432	7. 09	3, 094	22, 571	7. 30
Insecticides	48, 489	379, 919	7. 84	57, 747	484, 706	8. 39
Metallurgy	27, 619	250, 957	9. 09	52, 842	406, 420	7. 69
Paints	4, 369	36, 857	8. 44	5, 044	42, 472	8. 42
Paper mills	26, 581	186, 012	7. 00	25, 262	179, 478	7. 10
Petroleum	25, 669	234, 865	9. 15	23, 907	215, 937	9. 03
Sewage	9, 898	70, 252	7. 10	6, 293	52, 666	8. 37
Sugar	15, 355	193, 740	12. 62	13, 194	166, 728	12. 64
Tanneries	42, 892	304, 901	7. 11	41, 622	312, 852	7. 52
Water purification	170, 164	1, 267, 167	7. 45	182, 088	1, 407, 496	7. 73
Other uses	156, 726	1, 032, 305	6. 59	179, 443	1, 210, 264	6. 74
	555, 352	4, 192, 836	7. 55	614, 464	4, 720, 184	7. 68
Total hydrated lime	1, 293, 339	10, 290, 304	7. 96	1, 313, 388	10, 447, 050	7. 95

[1] Included under "Other uses."

TRENDS IN PRINCIPAL USES

Sales of "open-market" chemical lime since 1932 have trended upward strongly in each year except 1938, when a minor recession occurred. It is notable that the tonnage of chemical lime sold in 1943 was only slightly lower than the average total annual sales by the industry during 1925–29. The uptrend in use of refractory lime (dead-burned dolomite) continued throughout 1943, although at a lower rate of increase than in any year since 1938. The sharp decline in sales of building lime during 1942–43 to depression levels and the comparatively even trend in demand for agricultural lime are illustrated in figure 2.

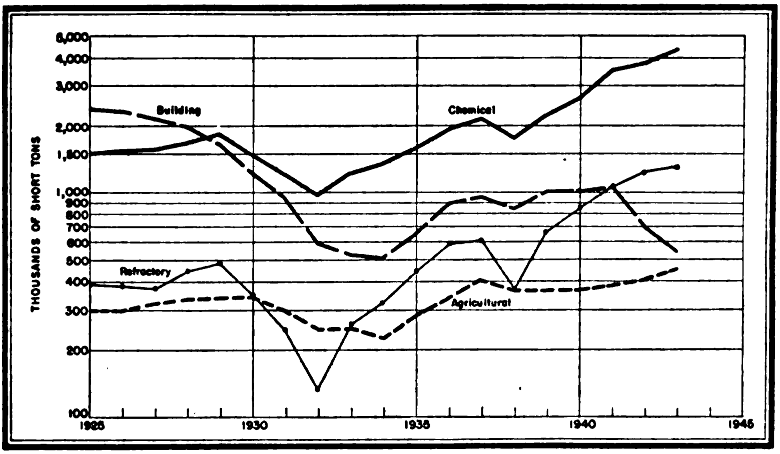

FIGURE 2.—Trends in major uses of lime, 1925–43.

SHIPMENTS

Total shipments.—Output exceeded apparent consumption in 12 of the 36 lime-producing States in 1943. However, the excess of out-of-State over into-State movements represented large tonnages only in Missouri, Ohio, Tennessee, and West Virginia. Indicated consumption in Pennsylvania in 1943 was much larger than in any other State, and the supply from local lime plants fell about 100,000 tons short of requirements. The other ranking States, in order of tonnage consumed, were Ohio, Illinois, and New York.

Sales, shipments, and supplies of lime available for consumption in continental United States, by States and groups of States, are listed in the two following tables.

Lime supplies available in continental United States in 1943, by States, in short tons

State	Sales by producers	Shipments from State[1]	Shipments into State	Supply		
				Quicklime	Hydrated lime	Total
Alabama	331, 182	87, 764	66, 723	297, 024	13, 117	310, 141
Arizona	71, 044	14, 519	3, 141	56, 942	2, 724	59. 666
Arkansas	(2)	(2)	(2)	164, 874	4, 455	169, 329
California	168, 502	16, 489	34, 870	148, 660	38, 223	186, 883
Colorado	(2)	(2)	(2)	37, 539	4, 892	42, 431
Connecticut	(2)	(2)	(2)	23, 554	14, 408	37, 962
Delaware			50, 032	35. 551	14, 481	50, 032
District of Columbia			13, 640	1, 419	12. 221	13, 640
Florida	20, 507		40, 710	42, 513	18, 704	61, 217
Georgia	8, 513	1, 140	69, 014	53, 271	23, 116	76, 387
Idaho			2, 484	858	1, 626	2, 484
Illinois	314, 736	120, 990	250, 338	372, 643	71, 441	444. 084
Indiana	(2)	(2)	(2)	177, 192	26, 434	203, 626
Iowa			64, 790	45. 964	18, 826	64. 790
Kansas			33, 189	13, 564	19, 625	33. 189
Kentucky			188, 370	178, 301	10, 069	188, 370
Louisiana	(2)	(2)	(2)	140. 243	21, 323	161, 566
Maine	(2)	(2)	(2)	60, 048	8, 599	68, 647
Maryland	78, 386	19, 271	146, 762	132. 585	73, 292	205, 877
Massachusetts	94, 877	61, 879	33. 005	34. 413	31, 590	66, 003
Michigan	96, 554	66, 414	225, 073	209, 793	45, 420	255, 213
Minnesota	(2)	(2)	(2)	54, 219	11, 042	65, 261
Mississippi			10, 183	5, 265	4, 918	10, 183
Missouri	963, 301	675. 375	15, 580	208, 495	95, 011	303, 506
Montana	(2)	(2)	(2)	33, 809	3, 223	37, 032
Nebraska			10, 347	2, 501	7, 846	10, 347
Nevada	(2)	(2)	(2)	33, 392	1, 117	34, 509
New Hampshire			9, 857	7, 475	2, 382	9, 857
New Jersey	(2)	(2)	(2)	69, 082	96. 431	165, 513
New Mexico	(2)	(2)	(2)	12, 886	2, 806	15, 692
New York	121, 890	36, 495	297, 314	300, 086	82. 623	382, 709
North Carolina	(2)	(2)	(2)	46, 564	26. 271	72, 835
North Dakota			6, 492	216	6, 276	6, 492
Ohio	1, 469, 654	933, 423	206. 531	634, 921	107, 841	742, 762
Oklahoma	(2)	(2)	(2)	22, 288	8, 807	31, 095
Oregon	(2)	(2)	(2)	28, 468	5, 073	33, 541
Pennsylvania	1, 021, 215	420, 195	520, 992	945, 100	176, 912	1, 122, 012
Rhode Island			8, 654	4, 836	3, 818	8, 654
South Carolina			20, 246	11, 707	8, 539	20, 246
South Dakota	(2)	(2)	(2)	619	2, 780	3. 399
Tennessee	235, 854	197, 476	9, 904	21, 262	27, 020	48, 282
Texas	132, 167	62, 831	14, 255	54, 208	29, 383	83, 591
Utah	59, 811	587	4, 093	53. 861	9, 456	63, 317
Vermont	51, 011	29, 115	249	21, 314	831	22, 145
Virginia	194, 974	130, 551	78, 508	101, 834	41, 097	142, 931
Washington	(2)	(2)	(2)	29. 140	9, 771	38, 911
West Virginia	492. 292	453, 775	214, 955	236, 245	17, 227	253, 472
Wisconsin	82, 913	39, 997	70, 469	85, 468	27, 917	113, 385
Wyoming			983	84	899	983
Undistributed[3]	571, 446	242, 379	852, 282			
	6, 580, 829	3, 610, 665	3, 574, 035	5, 252, 296	1, 291, 903	6, 544, 199

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[1] Includes 52,416 tons exported or unclassified as to destination.
[2] Included under "Undistributed."
[3] Includes items entered as "(2)."

Lime shipped (supply) in continental United States, in 1943, by origin and destination of shipments, in short tons

Destination	Origin														
	Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Vermont			Florida, Georgia, North Carolina, Virginia			Alabama, Louisiana, Tennessee		
	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio	1, 011, 165	193, 454	1,204,619	125, 358	8. 086	133, 444	106	10	116	6, 694	2, 082	8, 776	624	877	1, 501
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	423, 422	112, 148	535, 570	1, 150, 417	318, 221	1, 468, 638	23, 371	18, 540	41, 911	79, 314	19, 993	99, 307	21, 082	1, 015	22, 097
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	2, 079	9, 152	11, 231	58, 033	5, 002	63, 035	91, 296	46, 879	138, 175	232	175	407	-------	-------	-------
Florida, Georgia, North Carolina, South Carolina, Virginia	8, 218	25, 264	33, 482	44, 318	14, 299	58, 617	70	-------	70	65, 301	45, 797	111, 098	133, 748	31, 372	165, 120
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	60, 070	13, 653	73, 723	2, 507	1, 607	4, 114	-------	1	1	164	1, 722	1, 886	332, 401	46, 765	379, 166
Arkansas, Kansas, Nebraska, Oklahoma, Texas	2, 834	2, 799	5, 633	311	-------	311	-------	-------	-------	-------	-------	-------	489	35	524
Iowa, Minnesota, Missouri, Wisconsin	52, 758	29, 626	82, 384	35	44	79	-------	-------	-------	-------	-------	-------	-------	25	25
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	11, 945	2, 223	14, 168	97	5	102	-------	-------	-------	-------	251	251	-------	-------	-------

Destination	Origin—Continued											
	Arkansas, Oklahoma, Texas			Minnesota, Missouri, Wisconsin			Arizona, California, Colorado, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington			United States		
	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio	-------	190	190	250, 602	46, 437	297, 039	-------	-------	-------	1, 394, 549	251, 136	1, 645, 685
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	-------	4	4	22, 462	3, 266	25, 728	-------	-------	-------	1,720, 068	473, 187	2, 193, 255
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	-------	-------	-------	-------	420	420	-------	-------	-------	151, 640	61, 628	213, 268
Florida, Georgia, North Carolina, South Carolina, Virginia	2, 699	-------	2, 699	1, 535	995	2, 530	-------	-------	-------	255, 889	117, 727	373, 616
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	72, 280	5, 740	78, 020	174, 673	6, 959	181, 632	-------	-------	-------	642, 095	76, 447	718, 542
Arkansas, Kansas, Nebraska, Oklahoma, Texas	145, 785	40, 206	185, 991	108, 016	27, 076	135, 092	-------	-------	-------	257, 435	70, 116	327, 551
Iowa, Minnesota, Missouri, Wisconsin	7, 894	202	8, 096	333, 459	122, 899	456, 358	-------	-------	-------	394, 146	152, 796	546, 942
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	3, 599	3, 743	7, 342	6, 265	11, 345	17, 610	414, 568	71, 299	485, 867	436, 474	88, 866	525, 340

Hydrated lime.—The distribution of hydrated lime into groups of States from all producing plants and from Ohio plants are listed in the following table.

Shipments of hydrated lime from plants in continental United States and in Ohio in 1943, by destinations

Destination	From all plants		From Ohio plants		
	Short tons	Distribution (percent)	Short tons	Distribution (percent)	Percent of total shipments
Illinois, Indiana, Michigan, Ohio	251,136	19	156,857	47	62
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	473,187	36	110,988	33	23
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	61,628	5	9,152	3	15
Florida, Georgia, North Carolina, South Carolina, Virginia	117,727	9	25,264	7	21
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	76,447	6	10,845	3	14
Arkansas, Kansas, Nebraska, Oklahoma, Texas	70,116	5	2,669	1	4
Iowa, Minnesota, Missouri, Wisconsin	152,796	12	17,065	5	11
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	88,866	7	1,989	1	2
Undistributed and exports	9,487	1	55	(1)	1
	1,301,390	100	334,884	100	26

[1] Less than 0.1 percent.

MILL VALUES

The net mill realization (excluding container cost) per ton of lime sold in the open market in 1943 averaged $7.44, a gain of 17 cents over the 1942 figure. This increase apparently resulted principally from the scattered price increases allowed by the Office of Price Administration to producers whose costs had risen in such degree that production could not be maintained without higher prices. In 1943 the net mill value per ton of both quick and hydrated lime increased over 1942 for each of the major uses except building, for which the values declined slightly.

NEW DEVELOPMENTS

The combination of a traveling-grate stoker-coking unit with a rotary limekiln in a carbide plant has been successful.[1] Coke is produced in the stoker, and the large volume of hot, relatively low B. t. u., combustible gases pass directly into the rotary kiln. The lime is soft-burned, and ring formation in the kiln is virtually absent. Maximum heat utilization is attained through use of waste-heat boilers.

Results of research on the measurement and determination of the physical properties of lime that are desirable for the various uses of lime were described.[2]

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[1] Andersen, A. H., The Travelling-Grate Coking Process as Applied to a Rotary Limekiln: Trans. Canadian Inst. Min. and Met. Eng., vol. 47, 1944, pp. 1-13.

[2] McAllister, R. W., Useful Properties of Lime: Rock Products, vol. 45, No. 10, October 1942, pp. 48-51.

SIZE OF PLANTS

The effects of the war on lime plants with small annual production are illustrated by the data on groupings of plants according to size of output. As reported by producers, the labor shortage and the squeeze between rising production costs and ceiling prices have been the principal reasons for closing many of the plants that shut down during 1942 and 1943. From the figures below, it is apparent that most of the shut-downs have been in the small size groups. In 1943 the number of plants in each group under 25,000 tons of annual production was less than in 1942 and 1941, whereas in the groups over 25,000 tons the number of plants increased. Five cement plants that were converted in part to lime production are included in the 1943 data. The aggregate output of all plants producing less than 25,000 tons was only 15 percent of the total lime production in 1943.

Distribution of lime (including refractory) plants, 1941–43, according to size of production

Size group (short tons)	1941			1942			1943		
	Plants	Production		Plants	Production		Plants	Production	
		Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total
Less than 1,000	78	24,203	------	48	17,844	------	40	15,397	------
1,000 and less than 5,000	68	172,754	3	72	195,265	3	61	164,490	2
5,000 and less than 10,000	40	284,012	5	28	192,497	3	22	170,838	3
10,000 and less than 25,000	50	806,965	13	49	802,353	13	41	644,329	10
25,000 and less than 50,000	39	1,390,684	23	39	1,383,782	23	41	1,497,984	23
50,000 and less than 100,000	22	1,525,313	25	21	1,441,995	24	24	1,549,527	23
100,000 and over	12	1,875,485	31	13	2,070,055	34	16	2,554,050	39
	309	6,079,416	100	270	6,103,791	100	245	6,596,615	100

FOREIGN TRADE [3]

Imports.—The flow of lime from Canada to ports on the west coast of this country represents virtually all of the import trade in this commodity.

Lime imported for consumption in the United States, 1939–42 [1]

Year	Hydrated lime		Other lime		Dead-burned dolomite [2]		Total	
	Short tons [3]	Value	Short tons [3]	Value	Short tons [3]	Value	Short tons	Value
1939	1,148	$11,242	6,546	$60,660	186	$4,260	7,880	$76,162
1940	712	6,558	8,493	75,330	----------	----------	9,205	81,888
1941	808	8,827	11,747	100,127	64	654	12,619	109,608
1942	655	6,722	7,445	66,893	401	11,260	8,501	84,875

[1] Data for 1943 not available for publication.

[2] "Dead-burned basic refractory material containing 6 percent or more of lime and consisting chiefly of magnesia and lime."

[3] Includes weight of immediate container.

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[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Lime imported for consumption in the United States, 1941–42, by countries and customs districts [1] [2]

Country	Customs district	1941		1942	
		Short tons [3]	Value	Short tons [3]	Value
Canada	Florida	15	$120		
	Los Angeles	390	3,711	225	$2,247
	Maine and New Hampshire	13	98	106	785
	St. Lawrence	8	184	1	25
	San Francisco	4,778	43,985	2,089	22,777
	Vermont	4	83		
	Washington	7,344	60,689	5,635	47,325
Chile	New York	8	84		
Dominican Republic	Puerto Rico			44	456
		12,555	108,954	8,100	73,615

[1] 1943 data not available for publication.
[2] Exclusive of dead-burned basic refractory material.
[3] Includes weight of immediate container.

Exports.—Export trade in lime during 1941 and 1942 almost entirely comprised shipments to other countries in the Western Hemisphere.

Shipments of lime from the United States to noncontiguous Territories in 1941 were: 526 short tons valued at $9,069 to Hawaii; 710 tons, $9,186, to Puerto Rico; and 50 tons, $1,035, to the Virgin Islands.

Lime exported from the United States, 1938–43

Year	Short tons	Value	Year	Short tons	Value
1938	13,222	$121,662	1941	46,500	$475,540
1939	21,477	236,497	1942	36,061	400,845
1940	31,912	311,619	1943	(1)	(1)

[1] Data not available for publication.

Lime exported from the United States, 1941–42, by countries [1]

	1941		1942	
	Short tons	Value	Short tons	Value
Argentina	32	$1,280	10	$289
Brazil	125	2,613	11	291
Canada	5,810	39,895	8,984	64,202
Chile	85	1,509	60	1,061
Colombia	1,884	20,623	369	4,418
Costa Rica	4,984	49,830	2,465	21,456
Dominican Republic			7	123
Ecuador	254	2,355	40	220
El Salvador	511	1,210	85	1,324
Guatemala	10,979	112,360	5,841	68,880
Haiti	170	1,908	408	4,677
Honduras	12,356	122,219	10,674	129,990
Mexico	1,163	9,041	1,494	12,698
Nicaragua	899	11,399	1,730	9,935
Panama: Republic of	3,143	33,073	1,827	20,065
Peru	1,234	15,245	337	2,866
Venezuela	79	1,234	10	241
Other countries	2,792	49,746	1,709	58,109
	46,500	475,540	36,061	400,845

[1] 1943 data not available for publication.

CLAYS

By G. W. JOSEPHSON AND A. LINN[1]

SUMMARY OUTLINE

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GENERAL SUMMARY

As the United States reached peak rates in the production of military equipment the output of some clays likewise expanded, whereas others declined. In wartime, commodities may rise to boom levels and slump to the depths of depression in a matter of months. During the construction period almost all clays reached new highs. Heavy-clay products were in great demand for factories and housing; without fire-clay refractories the expansion and maintenance of the high-temperature industries would have been virtually impossible; bentonite, kaolin, ball clay, and fuller's earth all made substantial contributions through old and new uses.

In 1943 construction was nearing completion, and emphasis shifted to military production. Demand for building brick and other heavy-clay products was reduced to a point so low that many plants closed for the duration. Others found great difficulty in continuing in the face of increased costs and manpower shortages.

On the other hand, some clays fared very well. Fire-clay requirements declined slightly as building programs in the metal, power, and glass industries reached completion. Maintenance will continue to consume refractories at a high rate. Markets for kaolin and ball clay contracted somewhat but still compared favorably with pre-war standards. Bentonite, finding a larger market in foundries and oil-well drilling, established a new sales record, and fuller's earth regained much of the volume lost since 1930.

The security of foreign shipping is ordinarily of little consequence to the clay industry. The United States has ample supplies of all types of clay, and imports are limited to certain specialties, such as English ball and china clays. Moderate tonnages of fire clay, bentonite, and other high-quality domestic clays are exported. Notwithstanding a great improvement in the shipping situation in 1943, both exports (163,539 tons) and imports (71,478 tons) were lower than in 1942.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Shipping problems have had special significance for clay during the past 2 years because interest in the use of clay as an ore of aluminum stems from the fact that the United States depends on Surinam for most of its bauxite. As shipping in the Caribbean became more secure and an over-supply of aluminum accumulated, large-scale programs designed to produce the metal from clay lost much of their impetus. On the other hand, many people continued to advocate the further development of the processes on a plant scale as a guarantee of future safety. At the end of the year plant erection was proceeding.

Prices of fire and common clays remained under the provisions of Maximum Price Regulation 188, and on February 16, 1943, kaolin, bentonite, and fuller's earth were placed under MPR 327. A subsequent amendment also placed ball, slip, and stoneware clays under the latter. These regulations continued the ceiling prices established by the General Maximum Price Regulation and outlined procedures through which producers could obtain relief. In a few instances, adjustments were granted to individual companies, but no general rise in prices was approved by the Office of Price Administration.

Salient statistics of the clay industry in the United States, 1930–43

	1930–34 (average)	1935–39 (average)	1940	1941	1942	1943
Domestic clay sold or used by producers:						
Kaolin, china clay.....short tons..	431,932	654,147	833,450	1,087,848	946,588	929,437
Ball clay......................do....	70,299	108,525	140,707	198,445	162,293	147,785
Fire clay [1] (including stoneware clay).................short tons..	1,487,364	2,175,309	2,765,247	4,167,567	4,839,332	4,701,144
Bentonite.....................do....	84,762	188,385	251,032	354,028	374,967	480,202
Fuller's earth.................do....	259,354	204,529	146,568	207,446	204,244	271,667
Miscellaneous clays [1]........do....	305,973	360,602	710,515	1,210,168	1,019,663	850,397
Total domestic:						
Quantity...............do....	2,639,684	3,691,497	4,847,519	7,225,502	7,547,087	7,380,632
Value........................	$10,977,776	$15,455,392	$19,633,568	$27,037,391	$26,662,897	$27,654,732
Imports:						
Kaolin or china clay...short tons..	140,888	122,232	105,567	85,141	63,278	55,565
Common blue and Gross-Almerode................short tons..	11,306	27,108	32,141	26,825	19,790	15,509
Fuller's earth.................do....	4,708	2,256	474	342	287	157
Other clay....................do....	24,713	16,922	2,267	154	169	247
Total imports:						
Quantity...............do....	181,615	168,518	140,449	112,462	83,524	71,478
Value........................	$1,595,101	$1,608,395	$1,159,790	$1,152,915	$862,907	$730,213
Exports:						
Fire clay..............short tons..	39,709	61,247	96,501	91,732	118,101	97,362
Other clay (including fuller's earth)...............short tons..	68,978	87,824	87,667	116,120	75,098	66,177
Total exports:						
Quantity...............do....	108,687	149,071	184,168	207,852	193,199	163,539
Value........................	$1,323,744	$1,819,242	$2,071,336	$2,537,763	$2,042,940	$1,802,517

[1] Does not include clay burned into clay products in integrated plants at mine or pit.

POST-WAR PROSPECTS

Although clay will face strong competition from other building materials, both old and new, it probably will retain a substantial part of its present popularity in home and industrial construction during the years immediately after the war. However, new materials and fabrication methods are being developed at a rate that constitutes a challenge to clay over a period of years, and much will depend on the vigor with which clay products manufacturers meet rival claims of advantages in insulating value, price, appearance, and convenience. Unquestionably there is an accumulated demand for new homes that can reach boom proportions over an extended period if financial conditions are favorable.

When armament production is reduced, the volume of fire clay consumed is certain to decline, but it may not drop to pre-war levels. Bentonite and fuller's earth are also closely geared to war production and are likely to decrease, although expanding acceptance of these in new uses may largely counteract other losses.

Under prosperous conditions kaolin and ball clay may retain most of their 1943 volume in spite of the fact that unlimited quantities of imported clays again will be available.

Substantial markets will exist for all the clays in the post-war period, and if adequate purchasing power is available the outlook is favorable.

CONSUMPTION AND USES

The accompanying table, which gives sales of specified domestic clays by kinds and uses for 1943, continues a series begun in 1921. Trends in the use of individual clays during the past 10 years are also shown by charts on other pages of this chapter. The consumption of all clays, including both captive and merchant types, totaled about 23,000,000 tons in 1943.

Clay sold or used by producers in the United States in 1943, by kinds and uses, in short tons

Use	Kaolin	Ball clay	Fire clay and stoneware clay [1]	Bentonite	Miscellaneous clay including slip clay [1]	Fuller's earth	Total [1]
Pottery and stoneware:							
Whiteware, etc.	86,921	132,237	3,888				223,046
Stoneware, including chemical stoneware			32,903				32,903
Art pottery, flowerpots, etc.		950	10,709		10,608		22,267
Slip for glazing		150			3,091		3,241
	86,921	133,337	47,500		13,699		281,457
Tile, high-grade	9,282	6,720	6,936				22,938
Kiln furniture, etc.:							
Saggers, pins, stilts	1,732		30,273				32,005
Wads			6,277				6,277
	1,732		36,550				38,282
Architectural terra cotta			3,842				3,842
Paper:							
Filler	350,408	750	389				351,547
Coating	194,778						194,778
	545,186	750	389				546,325
Rubber	50,964		10,259				61,223
Linoleum and oilcloth	4,468	1,400	5,474				11,342
Paints:							
Filler or extender	16,242	57	284				16,583
Calcimine	490		3,089				3,579
	16,732	57	3,373				20,162
Cement manufacture	12,674	177	450	3,136	202,428		218,865

[1] Does not include clay burned into clay products in integrated plants at mine or pit.

Clay sold or used by producers in the United States in 1943, by kinds and uses, in short tons—Continued

Use	Kaolin	Ball clay	Fire clay and stoneware clay [1]	Bentonite	Miscellaneous clay including slip clay [1]	Fuller's earth	Total [1]
Refractories:							
Firebrick and block	136,798	1,668	2,926,683		5,220		3,070,364
Bauxite, high-alumina brick	154		65,767				65,921
Fire-clay mortar, including clay processed for laying fire brick	2,812		334,237				337,049
Clay crucibles	1,120		17,368				18,488
Glass refractories	220		17,407				17,627
Zinc retorts and condensers			58,076				58,076
Foundries and steelworks	6,626		813,819	181.412	23,842	128	1,025,827
	147,725	1,668	4,233,357	181,412	29.062	128	4,593,352
Miscellaneous:							
Rotary drilling mud			787	68,841	179,874	5,233	254,735
Filtering and decolorizing oils (raw and activated earths)				158,671		[2] 237,852	396,523
Other filtering and clarifying				836		5,016	5,852
Artificial abrasives	480		1,594		2,172		4,246
Asbestos products	3,768	1,500	1,332		15,520		22,120
Chemicals	8,638		80,796	1,237			90,671
Enameling		750					750
Filler (other than paper or paint)	2,068			2,830		80	4,978
Plaster and plaster products	8,472				210		8,682
Concrete admixture, sealing dams, etc				1,494			1,494
Heavy-clay products			249,644		377,670		627,314
Other uses	30,327	1,426	18,861	61,745	29,762	23,358	165.479
	53,753	3,676	353,014	295,654	605.208	271,539	1,582.844
Grand total:							
1943	929,437	147,785	4,701,144	480,202	850,397	271,667	7,380,632
1942	946,588	162,293	4,839,332	374,967	1,019,663	204,244	7,547,087

[1] Does not include clay burned into clay products in integrated plants at mine or pit.
[2] Comprises following: Mineral oils, 218,423 tons; vegetable oils, 19,429 tons.

CHINA CLAY OR KAOLIN

Although shipments of kaolin declined 2 percent in tonnage in 1943 they were higher than in any previous year except 1941 and 1942 and were 42 percent greater than the 1935–39 average.

In 1943 Georgia alone supplied 79 and South Carolina 12 percent of the total output, the same percentages as in 1942. The remaining 9 percent was shared by 11 States.

Consumption by uses was very much the same as in 1942. Paper consumed 59 percent, refractories 16, pottery 9, rubber 5; and a variety of industries, such as chemicals, paint, and linoleum, absorbed the remaining 11 percent. Restrictions on the production of some types of paper, owing to emphasis on the strong packaging papers that require no kaolin, kept this market slightly below the peak attained in 1941, but the volume of paper-clay sales was still 18 percent higher than the 1939 level. Although lower than in 1941, sales of pottery kaolin were 78 percent greater than the average of the 5 years ended in 1939. Refractory kaolin continued in demand at more than double the pre-war volume; but as compared with 1942, 8 percent less was sold.

Although sales of kaolin for rubber compounding were virtually the same in 1942 and 1943, there is evidence that some ground was lost. Rubber fabrication was sharply reduced in 1942 and then increased, as more and more synthetic rubber became available in 1943. Therefore, less clay was used per unit of rubber manufactured in 1943. Part of this reduction may be explained by the fact that manufacturers are now prohibited from making many products that ordinarily require large quantities of filler, and resumption of this output will automatically benefit clay. On the other hand, synthetic rubber now requires the incorporation of certain reinforcing compounds, principally carbon black, in preference to clay-type fillers. However, synthetic rubber processing is undergoing rapid development, and future discoveries may change present practice completely. It is apparent that research and post-war policies on importation of natural rubber will have a profound effect on the market for kaolin in the rubber industry.

Prices of kaolins vary widely. Crude can be had for as little as $2.50, and special products may reach $40 per ton. Most of it sells between $6 and $15 per ton, depending on such factors as quality, degree of preparation, and location. The national average value reported by producers to the Bureau of Mines was $8.68 per ton, somewhat higher than in 1942 ($8.49). English kaolin, c. i. f. American ports, was quoted, lump $19 to $28 per long ton and air-floated $40 to $60.

China-clay imports have decreased steadily from 114,696 tons valued at $1,015,813 in 1939 to 55,565 tons valued at $584,532 in 1943. All but 737 tons that entered from Canada came from the United Kingdom. Kaolin serves as satisfactory ballast for ships

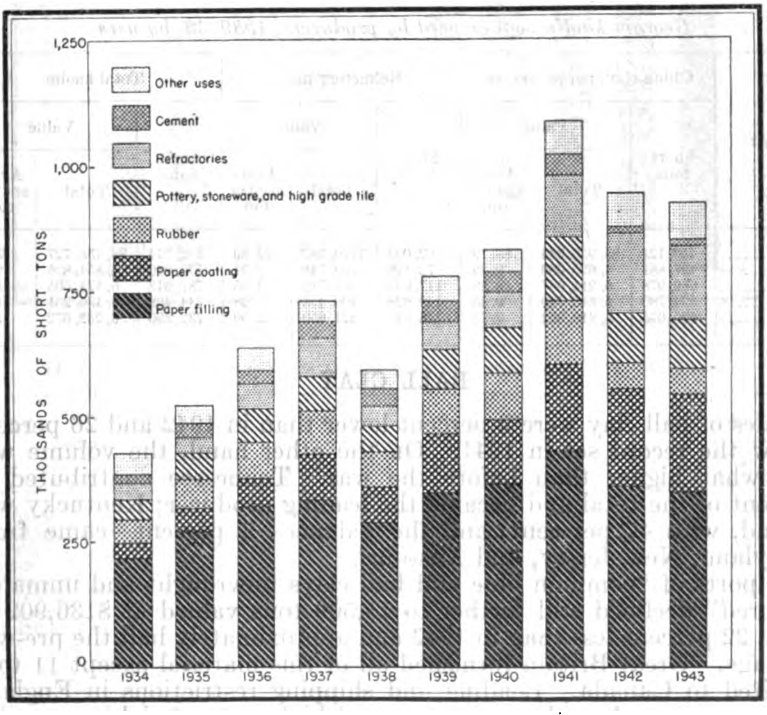

FIGURE 1.—Kaolin sold by domestic producers for specified uses, 1934–43.

returning from Britain, but routing problems and the danger of bombing while ships were detained in the war zone reduced the number of bottoms assigned to the transportation of relatively noncritical materials. English kaolin was included on the list of strategic raw materials by the Army and Navy Munitions Board because it is considered to be necessary in the production of high-quality ultramarine blue pigment, but this use represents only a small tonnage.

Kaolin sold or used by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	(1)	(1)	(1)	(1)
California	20,810	$164,110	10,237	$119,004	7,167	$81,855
Delaware	(1)	(1)	(1)	(1)	(1)	(1)
Florida	(1)	(1)	(1)	(1)	(1)	(1)
Georgia	787,013	6,573,605	744,408	6,136,231	732,590	6,232,572
Illinois	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	(1)	(1)	(1)	(1)	----------	----------
North Carolina	(1)	(1)	(1)	(1)	(1)	(1)
Pennsylvania	44,277	172,783	19,862	125,774	20,474	99,650
South Carolina	177,276	1,596,471	115,679	974,950	115,340	962,433
Tennessee	(1)	(1)	(1)	(1)	(1)	(1)
Utah	(1)	(1)	(1)	(1)	(1)	(1)
Vermont	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed [2]	58,472	698,923	56,402	681,274	53,866	690,812
	1,087,848	9,205,892	946,588	8,037,238	929,437	8,067,322

[1] Included under "Undistributed."

[2] Includes States indicated by "(1)" above.

Georgia kaolin sold or used by producers, 1939–43, by uses

Year	China clay, paper clay, etc.			Refractory uses			Total kaolin		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton
1939	450,121	$3,956,344	$8.79	62,093	$179,383	$2.89	512,214	$4,135,727	$8.07
1940	497,881	4,625,080	9.29	72,129	209,746	2.91	570,010	4,834,826	8.48
1941	669,978	6,216,087	9.28	117,035	357,518	3.05	787,013	6,573,605	8.35
1942	594,780	5,645,760	9.49	149,628	490,471	3.28	744,408	6,136,231	8.24
1943	596,075	5,810,922	9.75	136,515	421,650	3.09	732,590	6,232,572	8.51

BALL CLAY

Sales of ball clay were 9 percent lower than in 1942 and 26 percent below the record set in 1941. On the other hand, the volume was somewhat higher than before the war. Tennessee contributed 48 percent of the total and became the leading producer; Kentucky was second, with 47 per cent; and the balance—5 percent—came from Maryland, New Jersey, and Missouri.

Imports of "common blue and ball clays unwrought and unmanufactured" declined still further to 15,509 tons valued at $136,902 in 1943, 22 percent less than in 1942 and approximately half the pre-war tonnage. Great Britain furnished all of this material except 11 tons credited to Canada. Loading and shipping restrictions in England have contributed to the reduction, and high ocean freight costs give American ball clays an additional advantage in wartime. The average price of the imported material before shipping costs were added was $8.83 in 1943, somewhat lower than the $9.21 per ton reported in 1942.

Trade journals quoted Kentucky-Tennessee ball clay at $7, with air-floated bringing $14 and up. Maryland ball clay, shredded, bulk, brought $3 to $7 per ton, and air-floated, in paper bags, $10 to $18.25. The average value as reported by producers to the Bureau of Mines was $8.60 per ton, only slightly higher than the $8.49 obtained in 1942.

Although ball clay serves a useful purpose in a number of other products, such as linoleum, refractories, and asbestos, over 90 percent was consumed in pottery and 5 percent in high-grade tile. Much of the domestic ball clay is burned in New Jersey and Ohio potteries, whose high-grade products are sold throughout the country. Some interest is being shown in the development of potteries close to the source of raw material supply to reduce transportation cost on ware marketed in the Southern States.[3]

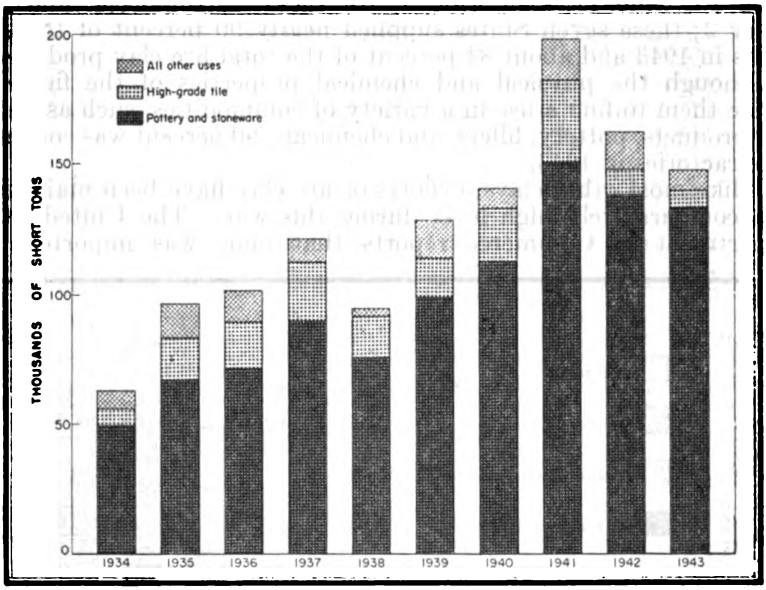

FIGURE 2.—Ball clay sold by domestic producers for specified uses, 1934–43.

Ball clay sold by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Kentucky	105, 586	$944, 705	80, 259	$696, 788	69, 982	$622, 309
Maryland	(1)	(1)	(1)	(1)	(1)	(1)
Mississippi	(1)	(1)	(1)	(1)		
Missouri	(1)	(1)	(1)	(1)	(1)	(1)
Nevada	(1)	(1)				
New Jersey	(1)	(1)	(1)	(1)	(1)	(1)
Tennessee	80, 506	664, 906	70, 573	606, 118	70, 606	593, 657
Undistributed [2]	12, 353	67, 989	11, 461	75, 599	7, 197	55, 508
	198, 445	1, 677, 600	162, 293	1, 378, 505	147, 785	1, 271, 474

[1] Included under "Undistributed." [2] Includes States indicated by "(1)."

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[3] Whitlatch, G. I., Sanitaryware Manufacture, a Post-War Industrial Opportunity for Tennessee: Reprint from Tennessee Planner, vol. 4, No. 1, September-October 1943, 8 pp.

FIRE CLAY

Consumption of fire clay began to taper off in 1943. Demand was still extremely high, by peacetime standards, but construction programs were reaching completion in the metal and other high-temperature process industries. The total output of fire clay (including both that shipped as raw clay and that burned into clay products at the mine or pit) declined 6 percent—from 8,296,745 tons in 1942 to 7,798,233 tons in 1943. The portion shipped as raw clay dropped only 3 percent, indicating that refractories producers tended to use the available labor in the plant while drawing their raw clay from more distant pits.

Fire clay is widely distributed, but quality and market advantages tend to concentrate activity in a few States. Shipments were reported from 30 States. Missouri contributed 26 percent, Pennsylvania 25, Ohio 17, California 8, Kentucky 7, Illinois 4, and New Jersey 2; these seven States supplied nearly 90 percent of the shipments in 1943 and about 84 percent of the total fire clay produced.

Although the physical and chemical properties of the fire clays enable them to find a use in a variety of commodities, such as heavy-clay products, pottery, fillers, and chemicals, 90 percent was consumed in refractories in 1943.

Unlike most other clays, exports of fire clay have been maintained at a comparatively high level during this war. The United States Department of Commerce reports that none was imported, but

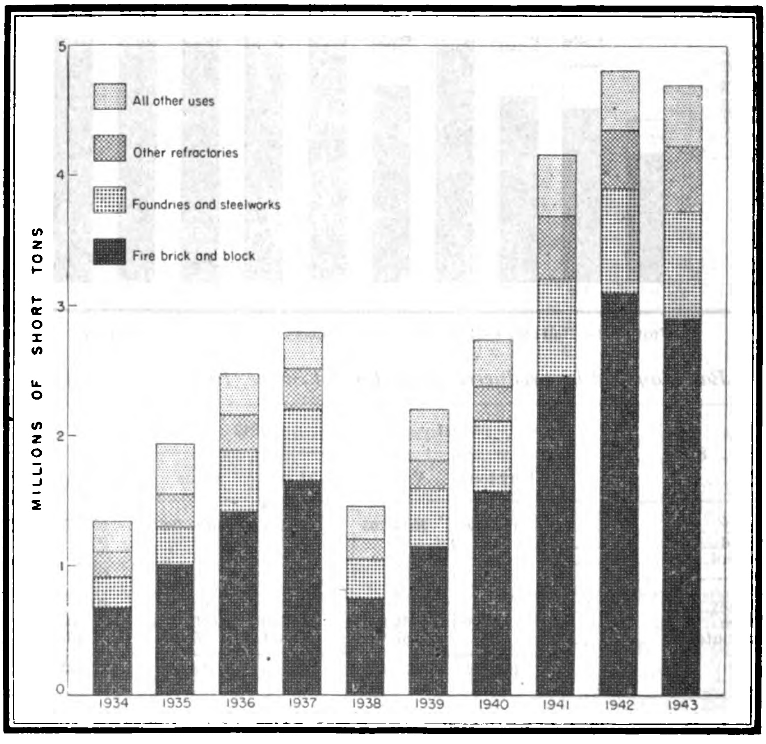

FIGURE 3.—Fire clay sold by domestic producers for specified uses, 1934–43.

97,362 tons valued at $636,079 were exported in 1943, somewhat less than the 118,101 tons of 1942 but more than the 91,732 tons of 1941. In contrast, only 66,177 tons of all other clays combined were exported in 1943.

Fire clay, including stoneware clay,[1] *sold or used by producers in the United States, 1941–43, by States*[2]

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	52,509	$108,703	96,567	$158,150	105,020	$190,176
California	316,226	714,779	433,571	999,901	379,862	887,283
Colorado	84,986	143,398	92,804	195,468	84,826	156,859
Illinois	201,139	448,002	180,994	329,212	185,034	333,170
Indiana	111,551	142,329	77,597	95,072	50,919	74,222
Kentucky	395,524	1,020,490	416,870	1,165,600	332,554	1,032,303
Maryland	17,790	99,229	15,213	75,590	14,672	90,060
Missouri [3]	794,705	1,782,139	1,110,962	2,450,752	1,231,305	2,526,315
New Jersey	133,126	714,925	112,041	639,794	117,429	675,145
New Mexico	(4)	(4)	4,634	11,349	4,394	11,399
Ohio	689,187	1,689,308	790,489	1,627,800	788,119	1,607,107
Pennsylvania	1,130,525	2,848,049	1,242,058	3,082,851	1,159,220	3,084,136
South Carolina	4,046	7,576	(4)	(4)	(4)	(4)
Tennessee	38,120	117,168	44,260	166,046	23,579	100,774
Texas	31,646	45,880	45,791	61,499	38,546	48,104
Utah	15,473	31,150	16,525	32,667	12,794	30,882
Washington	65,521	91,604	70,468	108,674	83,198	118,269
West Virginia	70,885	133,300	74,141	146,245	68,564	138,304
Other States [5]	14,608	49,704	14,347	34,836	21,109	65,414
	4,167,567	10,187,733	4,839,332	11,381,506	4,701,144	11,160,922

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[1] Includes stoneware clay as follows: 1941, 97,280 short tons valued at $159,507; 1942, 122,752 tons, $179,464; 1943, 104,837 tons, $165,996.

[2] Does not include clay burned into clay products in integrated plants at mine or pit.

[3] Includes diaspore and burley clay as follows: 1941, 79,897 short tons valued at $405,673; 1942, 119,357 tons, $591,124; 1943, diaspore, 58 299 tons valued at $359,435; burley, 76,857 tons, $245,426.

[4] Included under "Other States."

[5] Includes States indicated by "(4)" above and Arkansas, Idaho, Iowa, Massachusetts, Michigan (1943), Minnesota, Mississippi (1941), Montana (1942–43), Nebraska, Nevada, North Carolina (1941), North Dakota, Oregon, Vermont (1941), and Virginia.

BENTONITE

The rapid growth in the use of bentonite continued in 1943, and a new record was attained 28 percent greater than the previous high (set in 1942). Demand increased in most uses. Foundries and steelworks took 21, filtering and decolorizing oils 36, and expanded oil-well drilling programs 41 percent more than in 1942. Decreases were reported in some minor uses, but they were far overshadowed by the expansion in the large consuming industries. Of the total sales, foundries and steelworks consumed 38, filtering and decolorizing oils 33, and rotary drilling mud 14 percent—a total of 85 percent.

Output increased in all seven producing States. The popularity of bentonite from the Wyoming-South Dakota area is demonstrated by the fact that these two States supplied 59 percent of the total tonnage and 74 percent of the value in 1943. Wyoming was the leading producer, with 33 percent of the national total. Shipments from South Dakota were 41 percent greater than in 1942, continuing an expansion that has seen output grow from 20,565 tons in 1938 to 124,528 in 1943.

As production has increased the average value has decreased, partly owing to reductions in price but also because of the great expansion in use of the lower-priced grades. Trade journals quoted Wyoming dried and crushed bentonite at $7.50 per ton; pulverized, 200-mesh,

$9.50 to $11; and 325-mesh, bagged, $16. Most mine-run material is valued from $2 to $5 per ton, and at the other extreme very finely pulverized products may bring up to $35 per ton. The average value reported by producers in 1943 was $6.24, substantially less than the $6.80 recorded in 1942.

The records of the United States Department of Commerce show that no bentonite was imported in 1943. Export statistics on bentonite are not recorded separately, but producers reported to the Bureau of Mines that they exported 6,400 tons in 1943. This tonnage does not include dealer exports and acid-treated bentonite shipped to foreign oil refineries.

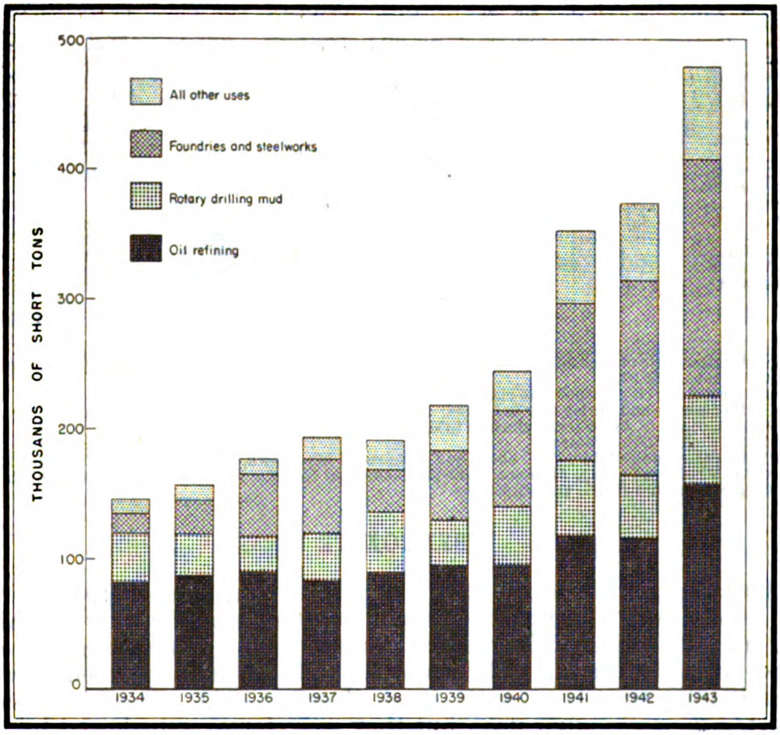

FIGURE 4.—Bentonite sold by domestic producers for specified uses, 1934–43.

Bentonite sold or used by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	6,981	$69,776	4,745	$48,522	7,104	$65,205
Mississippi	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	57,139	401,758	88,149	664,449	124,528	822,264
Texas	11,593	105,312	17,651	127,941	25,078	187,981
Utah	------	------	(1)	(1)	(1)	(1)
Wyoming	145,574	1,369,057	139,410	1,259,863	159,252	1,389,644
Undistributed [2]	132,741	505,997	125,012	447,734	164,240	532,660
	354,028	2,451,900	374,967	2,548,509	480,202	2,997,754

[1] Included under "Undistributed."

[2] Includes States indicated by "(1)."

FULLER'S EARTH

Assisted by expansion in new uses and shortages in the supply of competitive products, shipments of fuller's earth in 1943 were 33 percent greater than in 1942. Mineral oil refining consumed 80 percent and vegetable oil 7 percent of the total tonnage.

As indicated in figure 5, the consumption of fuller's earth declined sharply from 1930 to 1940. Its principal market—oil refining—was expanding, but improved refining methods and increased use of colored gasoline combined with strong competition from activated bentonite, bauxite, and synthetic magnesium silicate to reduce sales steadily.

The recovery in volume since 1940 has been attributed to a combination of factors, such as increased consumption per unit of petroleum product, owing to earlier rejection of fouled earth, and restrictions in the supply of competitive materials. Fuller's earth benefited from the enlarged oil-refining program, even though the expansion shown on the accompanying charted curve of petroleum-refining activity has been due largely to aviation gasoline and butadiene production, neither of which is a process consuming large quantities of fuller's earth.[3] If these are excluded an index number of 120 is attained for 1943. Fuller's earth finds some use as a catalyst as well as a decolorizer. In 1943 producers also reported that a substantial and increasing tonnage was sold for various adsorbent uses, for example, on the floors of machine shops.

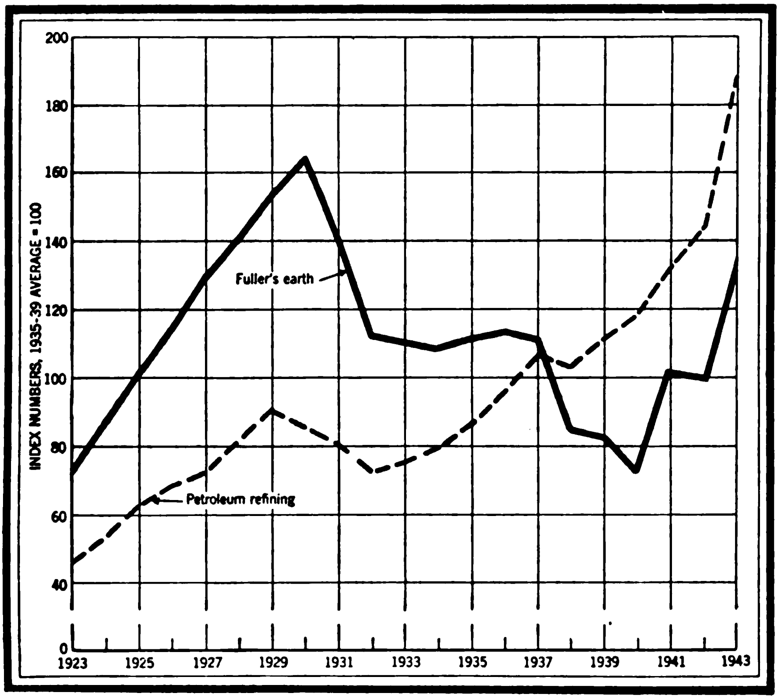

FIGURE 5.—Mine shipments of fuller's earth compared with petroleum-refining activity (Federal Reserve Board Index), 1923–43.

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[3] Information furnished by Petroleum Administration for War.

Texas was again the principal producer of fuller's earth, with 35 percent of the total tonnage. Georgia and Florida together supplied 39 percent and Illinois 24.

Whereas the value for the entire country was $10.56 per ton in 1943 ($10.48 in 1942), material from the Georgia-Florida district averaged $13.68, from Illinois $9, and from Texas $7.73.

Many fuller's earth products require considerable preparation to fit them for the intended application; therefore prices vary widely according to the cost of processing—from about $5.50 to $16 per ton. The variation is illustrated by current trade-journal quotations for Georgia-Florida material—30- to 60-mesh, $14.50; 15- to 30-mesh, $14; 200-mesh up, $10; 100-mesh up, $7.

Imports of fuller's earth in 1943 sank to 157 tons valued at $2,154, all from the United Kingdom. Before the war imports commonly ranged from 1,500 to 5,000 tons per year, but since 1940 they have not exceeded 500 tons.

Exports are not separately recorded by the United States Department of Commerce, but producers reported to the Bureau of Mines that 6,842 tons valued at $59,485 were shipped to Canada, the West Indies, and the Persian Gulf in 1943, approximately the same quantity as in 1942 (6,052 tons) but somewhat below the pre-war level (up to 11,000 tons yearly).

Fuller's earth sold or used by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Florida and Georgia	91,925	$1,075,318	83,007	$1,091,062	105,647	$1,444,936
Illinois	26,676	209,577	30,421	264,611	63,909	575,805
Texas	77,033	713,085	85,012	712,303	94,137	728,141
Other States [1]	11,812	113,694	5,804	71,694	7,974	118,926
	207,446	2,111,674	204,244	2,139,670	271,667	2,867,808

[1] Comprises the following: California, Colorado (1942), Nevada, New Mexico (1941), Tennessee (1941 and 1943), and Utah.

MISCELLANEOUS CLAYS

In addition to the generally recognized classes discussed in the foregoing sections of this chapter, other clays are grouped as miscellaneous owing to limited use or lack of uniform definition of their properties. The greater part of this tonnage consists of the common clays and shales used in making heavy-clay products and cement. Small quantities of slip clay are included, and the remainder is consumed in rotary drilling and for other purposes as outlined in the table of uses.

Most of this material is valued at less than $1 per ton; but some of the higher-priced products, such as slip clay and rotary drilling mud, are worth from $4 to over $10 per ton.

For a number of years the Bureau of Mines has emphasized that portion of the total output that was sold as raw or prepared clay or shipped by the mining company some distance to a plant before being converted into a salable product. Some statistics were gathered on clay burned into products at plants at the mine or pit, but only incidentally to the canvass of merchant clays. This practice gave an accurate measure of kaolin, ball clay, bentonite, fuller's earth, and even fire clay, as a substantial percentage of each is sold after comparatively little preparation, and the captive tonnage was also reported by the producers.

On the other hand, most of the clay used in the production of common brick, sewer pipe, and other heavy-clay products is mined close to the kilns and does not enter the market until it has been burned. Figures on this great tonnage have been intermittent or incomplete. In an attempt to fill this undesirable gap in the statistics of the clay industry the Bureau of Mines expanded its 1943 canvass to include this type of operation.

Similarly, most of the clay and shale used in the manufacture of cement is mined by the cement companies at nearby pits. The cement industry reported to the Bureau of Mines that it used 4,004,316 tons of clay and shale in 1943.

From reports of producers, substantiated by calculations based upon clay products figures furnished by the War Production Board, the total of "miscellaneous" clays consumed in 1943 was about 14,000,000 tons.

As shown by the accompanying table, the merchant clay portion comprised only a small fraction of this total. Being less dependent on the construction industry, it experienced a smaller decline in 1943 (17 percent) than did the captive tonnage. This is indicated by the fact that the cement industry required 23 percent less than the 5,181,582 tons it used in 1942, and the clay products output was little more than half as great as in the previous year. Sales of miscellaneous clays for use as drilling mud were 52 percent larger than in 1942.

Miscellaneous clay, including slip clay [1] *and shale, sold or used by producers in the United States, 1941–43, by States* [2]

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	125,563	$70,273	97,169	$55,470	77,678	$47,110
Arkansas	(3)	(3)	(3)	(3)	(3)	(3)
California	186,123	473,846	130,698	346,535	185,485	501,329
Colorado	79,458	83,246	40,954	45,356	17,067	19,208
Illinois	73,468	66,408	60,118	60,463	19,392	48,469
Indiana	106,362	34,038	97,390	32,890	5,623	3,987
Iowa	9,690	46,759	8,049	37,085	6,801	30,683
Missouri	(3)	(3)	(3)	(3)	10,669	11,983
Nebraska	11,949	5,748	15,953	13,691	12,717	14,554
Ohio	52,468	21,760	17,416	23,176	(3)	(3)
Pennsylvania	59,565	24,856	17,478	14,547	16,168	16,141
Texas	94,698	180,681	139,913	212,064	141,975	261,688
Washington	(3)	(3)	(3)	(3)	16,169	8,482
Other States [4]	410,824	394,977	394,525	336,197	340,653	316,818
	1,210,168	1,402,592	1,019,663	1,177,474	850,397	1,280,452

[1] Includes slip clay as follows—1941, 5,649 short tons, valued at $40,797, from Kentucky, Michigan, New York, Ohio, and Pennsylvania; 1942, 5,164 tons, $41,856, from Michigan and New York; 1943, 5,386 tons, $47,386, from Michigan and New York.

[2] Does not include clay burned into clay products in integrated plants at mine or pit.

[3] Included under "Other States."

[4] Includes States indicated by "(3)" above, and Connecticut (1941–42), Georgia, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nevada (1941), New Jersey, New Mexico, New York, Oklahoma, Oregon, Tennessee, Utah, and Wisconsin.

CLAY PRODUCTS

Demand for structural clay products dropped to a low point in 1943. War-plant building was nearing completion, and home construction was restricted by wartime limitations on the manufacture and use of many essential components. House construction was encouraged only in certain areas, particularly around war plants, where existing facilities were inadequate to handle the expanded population.

Clay products manufacturers had great difficulty in finding enough manpower to satisfy even the reduced demand, and inventories of brick dropped from 889,000,000 to 425,000,000 during the year. Many companies closed their plants for the duration of the war.

As indicated in the accompanying table, in 1943 the production of glazed and unglazed common and face brick, unglazed hollow facing tile, and unglazed structural tile was only 43 percent as high as in 1941, and the industry operated at about 21 percent of capacity.

Data on building brick and clay tile in the United States, 1940–43 [1] [2]

[Millions of brick or brick equivalent]

	1940	1941	1942	1943
Production	6,000	6,211	4,634	2,692
Estimated capacity	(3)	(3)	12,933	12,933
Stocks—January 1	1,112	1,149	1,000	889
Exports	36	37	29	(3)

[1] Abstracted from reports issued by War Production Board.

[2] Includes glazed and unglazed common and face brick, unglazed hollow facing tile, and unglazed structural clay tile. Sewer pipe and paving brick not included.

[3] Figures not available.

TECHNOLOGIC DEVELOPMENTS

In 1942 and early 1943 there was every indication that some of the processes by which aluminum can be derived from the aluminum silicates would have an opportunity to prove themselves on a commercial scale. Then submarine sinkings decreased, and it became evident that bauxite from Surinam was no longer likely to be cut off during this war. Simultaneously, stocks of aluminum began to mount until there was finally an oversupply despite the tremendous requirements of the aircraft industry.

Under these conditions new capacity was not welcome, and resistance to the clay program developed. Its advocates stressed the advantages of future national security to be gained, and at the end of the year erection of three plants was in progress or in preparation. Clay is to be the ore used by Ancor Corporation in South Carolina and by Columbia Metals Corporation in Oregon, whereas Monolith Portland Midwest Co. intends to use feldspar in Wyoming. The Ancor and Monolith plants are designed for lime-soda extraction and Columbia for the ammonium sulfate process.

Kalunite, Inc., which is now producing alumina from alunite in Utah, may also enter the clay field in the future.

In past years comparatively few clay products manufacturers have considered themselves in a position to conduct extensive research programs. Refractories producers have made real progress both in quality and processing methods, and these advances have been of great benefit in war production.[4] Additional interest is also developing among the manufacturers of heavy-clay products. Some companies that cannot afford full-scale research in their own plants can obtain vital information through cooperative action in trade associations [5] or through financial support of specific projects in universities or research institutes. Particular stress is being placed on maintaining the utility and economy of standard shapes in modern construction and the development of new products or designs to meet the competition of such materials as plywood, plastics, glass, and light metal, all of which hope to gain a larger portion of the building-material market after the war.

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[4] Austin, Chester R., Refractories Keep Pace With Industrial Progress: Brick and Clay Record, vol. 104, No. 1, January 1944, pp. 39–44.

[5] Brick and Clay Record, Clay Pressure Pipe Research in Progress: Vol. 103, No. 5, November 1943, p. 13.

ABRASIVE MATERIALS

By ROBERT W. METCALF AND A. B. CADE

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GENERAL CONDITIONS

The total value of products of the industries producing natural abrasives increased about 3 percent in 1943 compared with 1942. Garnet, emery, quartz, and ground sand and sandstone in 1943 had substantially higher values than in 1942. The value of ground sand and sandstone was the highest on record, and the values for garnet, emery, and quartz were the largest since 1929, 1918, and 1919, respectively. The values of the other products for which figures are given showed large decreases.

Salient statistics of the abrasives industries in the United States, 1942–43

	1942	1943	Percent of change in 1943
Domestic production (sold or used by producers):			
Natural silica abrasives:			
Diatomite	(1)	(1)	
Tripoli	$272, 428	$244, 365	−10
Quartz	331, 494	346, 558	+5
Ground sand and sandstone	3, 646, 643	3, 937, 452	+8
Special silica-stone products:			
Grindstones and pulpstones	539, 739	488, 205	−10
Oilstones and related products	(1)	(1)	
Millstones	10, 391	9, 240	−11
Flint lining and grinding pebbles	295, 761	203, 849	−31
Natural silicate abrasives:			
Pumice and pumicite	706, 199	611, 495	−13
Garnet	299, 904	429, 120	+43
Natural alumina abrasives:			
Corundum		(1)	
Emery	49, 413	63, 195	+28
Total natural abrasives [2]	6, 151, 972	6, 333, 479	+3
Total artificial abrasives [3]	[4] 23, 242, 559	26, 198, 001	+13
Foreign trade:			
Imports	22, 600, 738	22, 536, 052	−.3
Exports	6, 684, 352	3, 550, 528	−47

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[1] Bureau of Mines not at liberty to publish figures. Average for diatomite for 1939–41 was $1,915,405.

[2] Excludes value of corundum, diatomite, and oilstones and related products, which the Bureau of Mines is not at liberty to publish.

[3] Includes material produced in Canada; Bureau of Mines not at liberty to publish United States data separately.

[4] Revised figure.

The greatly increased need for abrasives in the enlarged industrial program stimulated by the war caused a corresponding rise in the production of crude manufactured (artificial) abrasives—silicon carbide, aluminum oxide, and metallic abrasives. All records were surpassed in both quantity and value by comparatively large margins. The combined total output of these materials, largely used for abrasive purposes, totaled 17 percent higher in tonnage and 13 percent more in value than in 1942, the former peak year. Production of aluminum oxide and silicon carbide was at virtual capacity (98 percent), and that of metallic abrasives at about 73 percent of capacity. Each class of product separately also established record outputs in 1943. Percentages of increase in tonnage in 1943 compared with 1942 were: Metallic abrasives (chilled iron and steel shot and grit), 17 percent; aluminum oxide, 18 percent; and silicon carbide, 13 percent.

The total value of imports of natural abrasive products into the United States was only slightly under the high figure reported in 1942. Imports of industrial diamonds (largely comprised in the classification "glaziers' and engravers', unset, and miners' diamonds") in 1943 surpassed by 8 percent the record-breaking year 1942, although the average value per carat declined 8 percent, indicating the increased consumption of smaller stones. There was a very large rise in imports of diamond dust. Corundum receipts in 1943 were 20 percent higher than in 1942 and only 3 percent under the peak (since 1924) year 1941. Pumice imports were small, as were those of tripoli and rottenstone. The total value of exports of abrasive products decreased 47 percent in 1943 compared with 1942, owing chiefly to the sharp drop in 1943 in the value of exports of emery and corundum wheels.

This chapter includes data for most of the materials used chiefly as abrasives, although certain clays, oxides, and substances mentioned later under "Miscellaneous mineral abrasive materials" are not included in the statistics presented herein. On the other hand, certain of the "abrasive materials" for which figures are shown also have important nonabrasive uses.

POST-WAR PROSPECTS

Although some recession may occur, at least during the change-over to a nonmilitary economy, the large backlog of potential demand for civilian housing and civilian goods of a wide variety undoubtedly should affect favorably the production and consumption of the products of the industries included in this chapter, with respect both to their abrasive and their nonabrasive uses. The resumption of full-scale manufacture of private automobiles and many other articles of domestic consumption will tend to cushion the cessation or, at least, the large reduction in manufacture of munitions, ships, and other war matériel. Not only will articles similar to pre-war goods be made, but also products or adaptations of the intensive research and development programs sponsored in connection with war activities. As virtually all modern industrial manufacturing operations are dependent upon abrasives at some stage in processing, and many industries employ abrasive materials for cutting, grinding, and polishing, those products having abrasive uses, as a whole, should follow the general trend of business activity in the days after the war.

In the post-war world, the market for insulation media, in particular, probably will expand greatly. The projected large increase in manufacture of air-conditioning equipment and its installation in private housing and public buildings should lead to the more general use in new construction of insulating materials for protection against heat in summer and cold in winter, as well as to achieve the evenly regulated temperatures required for optimum efficiency in many industrial operations. Diatomaceous earth and, to a lesser extent, pumice would be affected by this development. These two mineral substances also should be advantageously affected by the resurgence of private construction, as the use of diatomite in concrete and lightweight aggregate was growing when building was curtailed by Government order; and comparatively large quantities of pumice normally are employed in building operations, particularly in Western States. In high-temperature refractories and in the filtration of many liquids, diatomaceous earth also would share in the post-war market.

The diamond has attained such vast importance in war industry that a highly active demand for industrial grades should persist beyond the war period.

NATURAL SILICA ABRASIVES

Diatomite.—The Bureau of Mines has not been at liberty to publish annual production data for diatomite since 1926. Total output (sales) for 3-year periods, however, may be shown. Total sales for the three most recent of such periods were as follows: 1939–41: 360,502 short tons valued at $5,746,216; 1936–38: 279,645 tons valued at $4,377,353, and 1933–35: 244,342 tons valued at $3,618,428. Sales of diatomite in 1943 were somewhat higher in quantity and value than in 1942.

California and Oregon remained the principal producing States. Diatomite also was produced for sale in Florida, Idaho, Nevada, New Mexico, New York, and Washington.

Approximately the same distribution, according to percentages of total diatomite sales in 1943, prevailed for uses as in 1942—about half for filtration, one-quarter for insulation, one-sixth for fillers, and the remainder for miscellaneous uses, including small amounts for abrasives. In 1943, however, the figure for insulation was slightly under the 1942 percentage.

Quotations for diatomite throughout 1943, as reported in E&MJ Metal and Mineral Markets, were given as follows (prices are per ton on an f. o. b. mill, Nevada, basis): Crude, in bulk, dried, $7, nominal; 98- to 100-mesh, $20; low-temperature insulation, $19; high-temperature insulation, $30. Diatomite for fine abrasives was quoted at 2 cents per pound. Bags are extra.

An illustrated description of the diatomite deposit near Lompoc, Calif., in production for half a century and now owned and operated by Johns-Manville Products Corporation, includes a history of the company's growth and development, its research activities, and the varied uses in which its products are employed, including many applications of direct and vital significance to the efficient prosecution of the war.[1] Diatomaceous earth, up to about 5 percent of the pulp, incorporated into white patent coated liner cardboard gave better formation, higher brightness and opacity of the liner, and increased operating efficiency.[2] In the deinking of old used fiber comprising a portion of the liner stock, the highly absorptive qualities of diatomaceous earth aided in a quicker and more thorough removal of the ink and produced a uniformly higher brightness in the final washed pulp. Substitution of diatomite for flint in different types of ceramic glazes results in a definitely improved gloss but an off-white color.[3] Small quantities of diatomaceous earth are produced in South Africa for use as a packing material.[4] A deposit of high-grade diatomite was discovered in Sweden.[5]

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[1] The Power Specialist, The Diatom, 1893–1943: Vol. 19, Nos. 7-8, July-August 1943, pp. 3-7, 18-21.

Tripoli.—Production of tripoli decreased 15 percent to 14,912 short tons valued at $244,365 in 1943, compared with 17,536 tons valued at $272,428 in 1942, and was only slightly above the 1932 figure. Output in 1943 was reported from Arkansas, Illinois, Missouri, Oklahoma, and Pennsylvania (rottenstone).

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1939–43

Year	Illinois		Other States [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	11, 134	$148, 310	22, 340	$318, 070	33, 474	$466, 380
1940	11, 521	155, 576	18, 691	210, 993	30, 212	366, 569
1941	13. 833	200, 700	15, 468	221, 046	29, 301	421, 746
1942	12, 575	203, 390	4, 961	69, 038	17, 536	272, 428
1943	10, 203	168, 758	4, 709	75, 607	14, 912	244, 365

[1] 1939: Arkansas, California, Missouri, Oklahoma, Pennsylvania, Tennessee, and Texas; 1940–41: Arkansas, California, Missouri, Oklahoma, Pennsylvania, and Texas; 1942: Arkansas, Missouri, and Pennsylvania, 1943: Arkansas, Missouri, Oklahoma, and Pennsylvania.

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1941–43, by uses

Use	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasives	13, 407	$198, 252	5, 447	$85, 013	6, 146	$101, 248
Concrete admixture	1, 179	15, 168	754	8, 895	335	4, 690
Filler	10, 020	145, 063	8, 887	144, 055	6, 894	114, 929
Oil-well drilling	1, 925	22, 835	(1)	(1)	----------	----------
Other uses [2]	2, 770	40, 428	2, 448	34, 465	1, 537	23, 498
	29, 301	421, 746	17, 536	272, 428	14, 912	244, 365

[1] Included under "Other uses."
[2] 1941: Foundry facing and unspecified; 1942: Foundry facing, drilling mud, and unspecified; 1943: Filter block, foundry facing, and unspecified.

Tripoli used for abrasive purposes in 1943 increased 13 percent, and that employed as a filler decreased 22 percent compared with 1942. Concrete admixture, foundry facing, and filter block were among the other uses specified. No tripoli was reported sold for oil-well drilling mud in 1943.

Quotations for tripoli in 1943 taken from E&MJ Metal and Mineral Markets were the same as those reported in 1942, as follows (prices are per ton, f. o. b. Missouri, in paper-lined burlap bags, minimum carload, 30 tons): Once ground through 40-mesh, rose or cream colored, $14.50; double-ground through 110-mesh, rose or cream, $16; air-floated through 200-mesh, $26.

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[2] Chemical and Metallurgical Engineering, Diatomaceous Silica in Patent Coated Liner and Liner Stock: Vol. 50, No. 3, March 1943, p. 170.
[3] Keith, Wendell P., Use of Diatomite as a Source of Silica in Ceramic Glazes: Bull. Am. Ceram. Soc. vol. 22, No. 11, November 15, 1943, p. 373; Ceram. Abs., vol. 23, No. 1, January 15, 1944, p. 24.
[4] The South African Mining and Engineering Journal, October 16, 1943, p. 139.
[5] Foreign Commerce Weekly, vol. 12, No. 9, August 28, 1943, p. 26.

Quartz.—Sales of crude, crushed, and ground quartz from pegmatite veins or dikes and from quartzite in 1943 advanced sharply compared with 1942, with only a moderate increase in total realization. Comparable data for 1943 and 1942, with percentages of increase over 1942 in parentheses, follow: 1943, 99,445 short tons (51 percent) valued at $346,558 (5 percent); 1942, 65,878 tons, valued at $331,494. The tonnage in 1943 was the largest reported since 1917 (142,673 tons), and the value, the highest since 1919 ($373,571). Sales of crude quartz in 1943 were approximately three times those in 1942, but ground quartz sold amounted to only slightly over half the volume reported in 1942. Crushed quartz, however, showed the largest absolute change, owing chiefly to its greater use in the manufacture of ferrosilicon.

Quartz (crude, crushed, and ground)[1] *sold or used by producers in the United States, 1939–43*

Year	Crude		Crushed		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	13,739	$45,785	15,504	$49,186	5,716	$58,067	34,959	$153,038
1940	3,606	17,099	17,652	58,897	10,607	100,394	31,865	176,390
1941	8,977	39,247	24,101	94,913	8,607	94,427	41,685	228,587
1942	2,043	7,937	45,747	144,808	18,088	178,749	65,878	331,494
1943	6,134	55,600	84,233	183,507	9,078	107,451	99,445	346,558

[1] To avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

Eleven States produced quartz in 1943, compared with 15 in 1942. No output in 1943 was listed for New York, Ohio, Pennsylvania, and Texas.

Quartz (crude, crushed, and ground)[1] *sold or used by producers in the United States, 1941–43, by States*

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	3,974	$50,243	(2)	(2)	(2)	(2)
California			(2)	(2)	(2)	(2)
Oregon						
Maine	202	722	364	$922	140	$840
Maryland	(2)	(2)	(2)	(2)	827	12,737
Massachusetts	850	5,525	1,029	8,137	1,037	7,259
New Jersey	778	7,181			(2)	(2)
Ohio			975	8,649		
Pennsylvania						
North Carolina	(2)	(2)	(2)	(2)	8,684	84,530
Tennessee	(2)	(2)	(2)	(2)		
Virginia			(2)	(2)		
Texas	1,485	14,345	319	3,190		
Other States[3]	34,396	150,571	63,191	310,596	88,757	241,192
	41,685	228,587	65,878	331,494	99,445	346,558

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[1] To avoid duplication, the ground material included is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production

[2] Included under "Other States."

[3] 1941: Maryland, New Hampshire, New York, North Carolina, Tennessee, and Wisconsin; 1942: Arizona, California, Maryland, New York, North Carolina, Tennessee, Virginia, Washington, and Wisconsin; 1943: Arizona, California, New Jersey, Washington, and Wisconsin.

The chemical and physical properties of fused quartz were described in detail by Johnson.[6] Quartz from the Chestnut Flat mine of the Carolina China Clay Co., Penland, N. C., which was used in making the world's largest telescope, now is being purchased by a manufacturer of optical glass for use in high-quality lenses largely on military order.[7]

Ground sand and sandstone.—Sales of ground sand and sandstone in 1943 established new records in both quantity and value and totaled 541,350 short tons valued at $3,937,452, or 2 percent above 1917, the former record year in tonnage (532,454 tons), and 8 percent in value more than in 1942, the former peak year in total realization ($3,646,643). Tonnage marketed in 1943 was 3 percent greater than that reported for 1942. Output by States or groups of States for which comparisons are possible showed small gains in 1943 over 1942, except for New Jersey–Pennsylvania, where production (sales) decreased about 5 percent. States producing sizable tonnages of ground sand and sandstone are Illinois, New Jersey, Ohio, and Pennsylvania.

Ground sand and sandstone sold or used by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	310,512	$1,930,301	1942	527,886	$3,646,643
1940	342,218	2,088,314	1943	541,350	3,937,452
1941	487,665	3,073,730			

Ground sand and sandstone sold or used by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
California	(1)	(1)	8,371	$68,324	(1)	(1)
Washington	------	------			3,902	$25,485
Georgia	------	------	(1)	(1)	3,252	32,525
Illinois	131,581	$808,402	158,853	1,087,481	164,401	1,180,469
Massachusetts	1,352	6,327	2,761	13,948	3,148	16,050
New Jersey and Pennsylvania	174,305	954,929	188,598	1,143,746	179,634	1,119,640
Ohio, Virginia, and West Virginia	149,542	1,092,784	149,625	1,167,207	152,142	1,259,977
Other States[2]	30,885	211,288	19,678	165,937	34,871	303,306
	487,665	3,073,730	527,886	3,646,643	541,350	3,937,452

[1] Included under "Other States."

[2] 1941: California, Missouri, and Wisconsin; 1942: Georgia, Missouri, and Wisconsin; 1943: California, Missouri, North Carolina, and Wisconsin.

Distribution of sales, by uses, of ground sand and sandstone, as reported by 90 percent of the industry, reveals that the chief marketing outlets in 1943 were pottery, porcelain, and tile, foundries, and abrasives, in order of size of shipments. Manufacture of enamel and glass and users of various types of fillers consumed most of the remaining tonnage for which uses were reported.

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[6] Johnson, W. M., Fused Quartz—A Growing Engineering Material: Chem. Indust., Vol. 53, 1943, pp. 515–516. Ceram. Abs., January 15, 1944, pp. 8–9.

[7] Ashville (N. C.) Citizen Times, Quartz from W. N. C. (Western North Carolina) Used in Military Lenses and Radios; July 4, 1943.

Ground sand and sandstone sold or used by producers in the United States in 1943, by uses [1]

Use	Short tons	Value	
		Total	Average per ton
Abrasive:			
Cleansing and scouring compound	81,523	$473,409	$5.81
Other	384	2,706	7.05
Enamel	16,728	121,039	7.24
Filler	8,393	74,933	8.93
Foundry	156,587	1,021,058	6.52
Glass	15,781	112,028	7.10
Pottery, porcelain, and tile	185,737	1,583,062	8.52
Other uses	23,295	177,961	7.64
Total reported by uses	488,428	3,566,196	7.30

[1] Data represent 90 percent of the industry.

Abrasive sands.—Considerable tonnages of natural sands with a high silica content are employed for abrasive purposes, such as sand blasting, stone polishing, glass grinding, or sandpaper. In 1943, sales of grinding and polishing sand totaled 837,662 short tons valued at $1,428,463, compared with 806,878 tons valued at $1,363,168 in 1942. Included in the 1943 total are 450,997 tons of blast sand valued at $1,138,003—7 percent more in tonnage and 6 percent higher in value than that reported for 1942.

SPECIAL SILICA-STONE PRODUCTS

Grindstones and pulpstones.—Total sales of pulpstones and grindstones in 1943 aggregated 12,623 short tons valued at $488,205, a decrease of 14 percent in tonnage and 10 percent in value compared with 1942, and were the lowest in both quantity and value since 1939. Marketed production of grindstones in 1943 was 16 percent under 1942 but was considerably in excess of the tonnages sold in 1938–40. Output of pulpstones in 1943 declined 1 percent in tonnage and about 18 percent in value compared with 1942. As in most recent years, pulpstones were produced in Washington and West Virginia and grindstones in Ohio and West Virginia.

Grindstones and pulpstones sold by producers in the United States, 1939–43

Year	Grindstones		Pulpstones		
			Quantity		Value
	Short tons	Value	Pieces	Equivalent short tons	
1939	7,917	$257,350	672	2,517	$169,025
1940	8,790	284,809	901	4,533	211,639
1941	13,573	434,208	685	1,963	111,348
1942	12,763	422,763	528	1,918	116,976
1943	10,732	392,296	323	1,891	95,909

Oilstones and related products.—Sales of natural sharpening stones, including oilstones, whetstones, scythestones, and rubbing stones, were slightly smaller in 1943 than in 1942. The Bureau of Mines, however, has not been at liberty to publish sales figures since 1939. States in which production was made in 1943 and the type of stone reported from each State were as follows: Arkansas—oilstones and whetstones; Indiana—scythestones, hones, and rubbing stones; New Hampshire—

scythestones; and Ohio—scythestones, whetstones, and "other" sharpening stones, including lathestones.

Millstones.—The value of millstones in 1943 declined 11 percent, to $9,240, compared with $10,391 in 1942. In 1943, millstones were produced in Ulster County, N. Y. ("Esopus" stone from the Shawangunk conglomerate); Rowan County, N. C. (granite); and Montgomery County, Va. (a fine-grained quartzite known as "Brush Mountain" stone). Output of chasers also was reported from New York. Early accounts of the production of millstones or burrstones in England, Germany, and France describe mining, preparation, and marketing in the first part of the 19th century.[8]

Value of millstones, chasers, and dragstones sold by producers in the United States, 1939–43

Year	New York		Other States [1]		Total	
	Producers	Value	Producers	Value	Producers	Value
1939	6	$2,584	3	$8,500	9	$11,084
1940	3	(2)	2	(2)	5	6,558
1941	5	3,558	3	12,021	8	15,579
1942	2	(2)	3	(2)	5	10,391
1943	1	(2)	3	(2)	4	9,240

[1] 1939–40 and 1942–43: North Carolina and Virginia; 1941: North Carolina, Virginia, and West Virginia.
[2] Bureau of Mines not at liberty to publish figures.

Grinding pebbles and tube-mill liners.—Total sales of grinding pebbles and tube-mill liners in 1943 decreased 31 percent in both quantity and value compared with 1942. Sales of grinding pebbles were 36 percent under 1942. Tube-mill liners remained at virtually the same level as in 1942, although the average realization was somewhat lower. The Bureau of Mines was not able to publish totals for grinding pebbles and tube-mill liners from 1933 to 1941.

Grinding pebbles were produced in 5 States in 1943—California, Minnesota, North Carolina, Texas, and Wisconsin—and tube-mill liners were reported from 3 States—Minnesota, North Carolina, and Wisconsin. No production of pebbles from Elmore, Ala., was reported, as the Great Lakes Foundry Sand Co., Detroit, Mich., has discontinued operations there. Beach pebbles were gathered and sold by John T. Momand, Carlsbad, Calif.

Grinding pebbles and tube-mill liners sold or used by producers in the United States, 1941–43

Year	Grinding pebbles		Tube-mill liners		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	13,561	$221,826	3,411	$54,216	16,972	$276,042
1942	15,487	245,794	2,576	49,967	18,063	295,761
1943	9,924	157,778	2,585	46,071	12,509	203,849

Jasper Stone Co., Sioux City, Iowa, produced quartzite liners and artificially rounded quartzite grinding pebbles at Jasper, Minn. Charlotte Chemical Laboratories, Inc., Charlotte, N. C., produced milled silica pebbles near Lilesville, N. C.; and its affiliated firm, the Southern Products & Silica Co., also marketed Texas flint pebbles. Rounded granite cubes and granite liners were produced by the Harris

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[8] The Stone Trades Journal, Ancient Mill-Stone Quarries: Vol. 66, No. 6, June 1943, pp. 79–80.

Granite Quarries Co., Salisbury, N. C. Peeler & McCombs, Faith, N. C., also sold some granite cubes and liners produced in the same region.

Philip S. Hoyt, Van Horn, Tex., shipped flint pebbles from various locations, principally Bastrop and Colorado Counties, Texas. Both the Arlcy Mining Co., Pearsall, Tex., and Dezendorf Marble Co., Austin, Tex., shipped flint pebbles in 1943, although the Arlcy Mining Co. was reported to have discontinued operations in the spring of the year.

Quartzite pebbles and liners from Sauk County, Wis., were marketed by the Baraboo Quartzite Co., Baraboo, Wis. A detailed description of the quarry operations and the mill of this firm was published in the trade press.[9] In addition to its quartzite products, mill liners are produced from waste monumental granite, which is cut to size and tapered. A brief history of the mining and processing of grinding pebbles in the coastal plain of Texas and a detailed account of the occurrences in this region were given by Parkinson and Barnes.[10]

NATURAL SILICATE ABRASIVES

Pumice and pumicite.—The curtailment of private building operations due to wartime restrictions was chiefly responsible for the 33 percent decline in tonnage of pumice and pumicite sold in 1943. The value of sales decreased 13 percent. Sales in 1943, however, were larger than in any year previous to 1939.

As in 1942, pumice or pumicite was produced in 7 States. Output from Washington was reported in 1943, although no production was listed from Oregon. The shifts in relative rank of the States from 1942 to 1943, as shown in the accompanying table, as well as the tonnage changes, may be ascribed to the lack of active construction and the increased demand for abrasives and cleansing preparations.

Pumice and pumicite sold or used by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	89,159	$424,780	1942	126,522	$706,199
1940	82,407	449,914	1943	85,150	611,495
1941	117,310	669,514			

Pumice and pumicite sold or used by producers in the United States, 1941–43, by States

State	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
California	77,951	$268,734	74,925	$206,424	25,490	$160,441
Kansas	23,659	111,835	36,810	139,930	43,918	163,366
Nebraska	7,512	54,513	6,837	47,194	(1)	(1)
New Mexico	(1)	(1)	7,396	294,331	4,837	202,558
Oklahoma	(1)	(1)	(1)	(1)	(1)	(1)
Oregon	677	8,544	(1)	(1)	----	----
Texas	(1)	(1)	(1)	(1)	(1)	(1)
Washington	----	----	----	----	700	7,362
Undistributed[2]	7,511	225,888	554	18,320	10,205	77,768
	117,310	669,514	126,522	706,199	85,150	611,495

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

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[9] Pit and Quarry, Oxy-acetylene Drilling Expedites Production of Flint Grinding Pebbles: Vol. 36, No. 11, April 1944, pp. 68–70.

[10] Parkinson, George A., and Barnes, Virgil E., Grinding Pebble Deposits of Western Gulf Coastal Plain of Texas: Separate from The University of Texas Publication 4301, March 1944, pp. 47–54.

The use of pumice and pumicite for abrasive purposes expanded 17 percent in 1943, compared with 1942, and accounted for about 75 percent of total sales. (See fig. 1.) Consumption in building industries dropped decisively and reflected the drastic restrictions on private construction due to war regulations. Tonnage of pumice or pumicite used in acoustic plaster was 64 percent less in 1943 than in 1942, and the quantity consumed in the manufacture of concrete aggregate and concrete admixture decreased 70 percent. In addition to those uses for which tonnages are shown, other sales outlets included insecticides, brick manufacture, filtration, and paint filler.

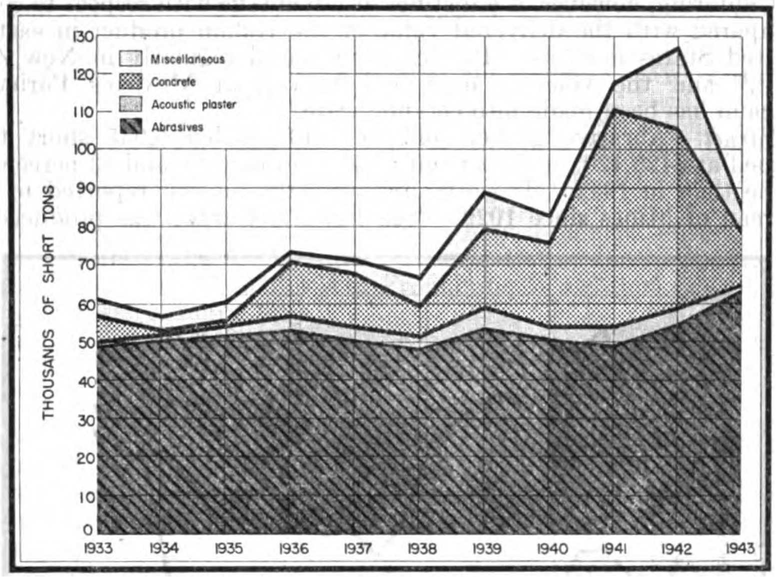

FIGURE 1.—Trends, by uses, of pumice and pumicite sold or used by producers in the United States, 1933–43.

Pumice and pumicite sold or used by producers in the United States, 1941–43, by uses

Use	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasive:						
Cleansing and scouring compounds and hand soaps	36, 246	$265, 361	50, 324	$353, 788	59, 247	$354, 242
Other abrasive uses	12, 785	127, 003	4, 084	90, 286	4, 216	64, 988
Acoustic plaster	4, 885	78, 538	4, 552	121, 551	1, 617	39, 860
Concrete admixture and concrete aggregate	56, 159	72, 242	46, 163	57, 219	13, 794	52, 718
Other uses [1]	7, 235	126, 370	21, 399	83, 355	6, 276	109, 687
	117, 310	669, 514	126, 522	706, 199	85, 150	611, 495

[1] 1941: Asphalt, insulating mediums, insecticide, paint products, and unspecified; 1942: Asphalt, insulation, insecticide, paint products, filtration, and unspecified; 1943: Asphalt, insecticide, paint filler, brick manufacture, filtration, solvents, and unspecified.

A description of the pumice recovery and processing procedure of operations of the Pumice Corporation of America, near Grants, N.

Mex., was published.[11] Recent improvements in grinding and refining have resulted in a pumice at least equivalent and in some respects superior to the Italian material formerly imported from Lipari Islands, according to the author. The long overland haul from New Mexico or California, however, is a distinct disadvantage with respect to costs, compared with the delivered value of the Italian product in eastern United States markets. Pumice is produced regularly in New Zealand,[12] and the volcanic dust and lava from Mexico's Paricutin volcano has been made into ceramic ware.[13]

Garnet.—Abrasive garnet sold in 1943 totaled 5,935 short tons valued at $429,120, or 36 percent higher in quantity and 43 percent in value than in 1942. These figures were the highest reported to the Bureau of Mines since 1929. (See fig. 2.) Garnet was produced in 1943 in Idaho, New York, and North Carolina. Quotations on garnet, as reported by E&MJ Metal and Mineral Markets, were unchanged during 1943: New York Adirondack garnet concentrates, grain, were listed at $85 per ton, and Spanish grades, c. i. f. port of entry, were nominally quoted at $70 per ton.

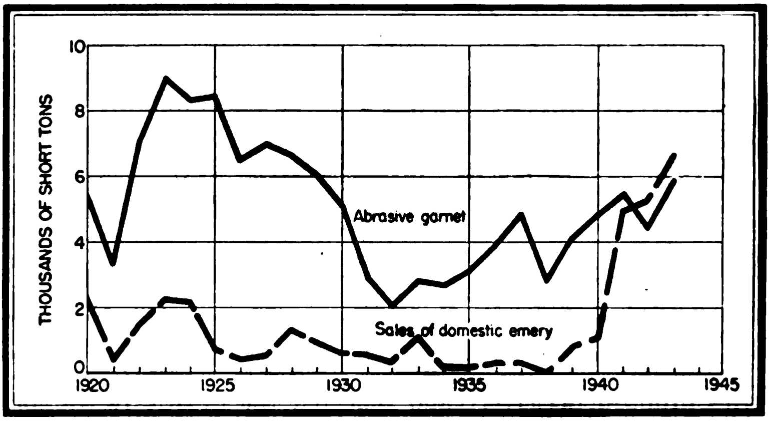

FIGURE 2.—Marketed production of abrasive garnet and domestic emery in the United States, 1920–43.

Abrasive garnet sold or used by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	4,056	$278,534	1942	4,357	$299,904
1940	4,716	259,345	1943	5,935	429,120
1941	5,501	371,752			

The first nonmetallic plant to adopt heavy-media separation (float-sink) processes and the first plant to use ferrosilicon as the separating medium other than in iron-ore treatment is the garnet-concentrating mill of the Barton Mines Corporation, North Creek, N. Y. Increased garnet production with existing equipment and at no additional labor cost and a greater proportion of garnet recovery in the minus ½-inch plus ⅛-inch range are among the advantages claimed by the operators.

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[11] Kutnewsky, Fremont, Pumice—Nature's Unique Abrasive: Compressed Air Mag., vol. 48, No. 6, June 1943, pp. 7063-7065.
[12] South African Mining and Engineering Journal, vol. 53, pt. 2, No. 2613, February 27, 1943, p. 572.
[13] Science News Letter, November 13, 1943, p. 312.

A detailed description of the mill (including a flow sheet) and its operation was published by Vogel.[14] A new fire-resistant nonskid deck covering especially adapted for use around gun emplacements on battleships has been perfected and is now in use by the Navy. The abrasive element consists chiefly of garnet or aluminum oxide particles held in a special plastic synthetic-resin binder. It is stored as a viscous fluid in metal containers, ready for use, and may be applied with a trowel or by spray guns to wood, concrete, or steel. Drying in a few hours, the coating is durable, unaffected by ordinary temperatures, and corrosion-resistant.[15] Of interest is the development of finely ground garnet as an abrasive for grinding vitally needed opthalmic and precision lenses in the optical industry. Actual production tests of properly classified garnet flours have produced finishes comparable to those obtained by the use of corundum or synthetic abrasive superfines, according to the War Production Board, but required 20 percent longer grinding time.

NATURAL ALUMINA ABRASIVES

Corundum.—Corundum, a natural alumina abrasive, is especially adapted for use in the manufacture of grinding wheels employed in essential industry and as a polishing agent for precision lenses. The coarser grain sizes are purchased by the grinding-wheel manufacturers and the finer-sized products by optical-lens makers. The fine dust remaining after use by the optical instrument grinders is sold to retail opticians.

Until 1943, no production of natural corundum had been reported in the United States since 1917 and 1918, and none previous to those years since 1906. By far, most of the corundum used in this country in recent years has been imported from the Union of South Africa, and small amounts in various years from several other countries. Because of the dangers incident to the long ocean haul from Africa, the shortage of shipping space, and the comparative scarcity of corundum reserves, intensive search for possible domestic commercial deposits was undertaken. Examination of known occurrences and revaluation of old abandoned properties were especially active in Montana, North Carolina, and South Carolina.

Mining operations were begun during 1943 in South Carolina by Withers, Inc., at a formerly active property near Clover. This deposit comprises three veins of corundum and contains material said to approximate closely in quality that received from Africa. Tests by the optical industry are understood to have been favorable.[16]

Emery.—Sales of domestic emery in 1943 increased 26 percent in tonnage and 28 percent in value, compared with 1942 (see fig. 2), and were the highest recorded since 1918. As in former years, the entire output was produced in the Peekskill (N. Y.) area. In addition to its augmented use in abrasive products, emery also is in demand as a nonslip, wear-resistant ingredient in concrete floors. According to E&MJ Metal and Mineral Markets, crude domestic emery ore was quoted in 1943 at $10 per ton for first-grade material f. o. b.

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[14] Vogel, H. H., Heavy-Media Separation Plant of the Barton Mines Corporation: Am. Inst. Min. and Met. Eng. Tech. Pub. 1578, 1943, 5 pp.

[15] Science News Letter, October 9, 1943, p. 234; Chemical and Metallurgical Engineering, Slip-proof Flooring: vol. 50, No. 11, November 1943, p. 172; Chemical and Engineering News, vol. 21, No. 23, December 10, 1943, p. 2051.

[16] Foreign Commerce Weekly, Domestic Corundum Partially Replacing Imports: Vol. 12, No. 4, July 24, 1943, p. 34.

New York. Australia has emery deposits of good quality, but distance from markets makes exploitation difficult.[17]

Emery sold or used by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	765	$6,828	1942	5,277	$49,413
1940	1,046	9,349	1943	6,666	63,195
1941	4,876	42,484			

NATURAL CARBON ABRASIVES [18]

Abrasive or industrial diamonds.—Estimates, considered reliable, have placed the value of total sales of industrial diamonds in 1943 at £6,000,000, compared with £4,250,000 in 1942 and £2,000,000 in 1941.[19] This large increase in sales of industrial stones is the result not only of the vast wartime manufacture of ships, planes, and munitions, but also of the more widely diversified use and applications of diamond-set tools for drilling, grinding, and wheel-dressing operations and the greatly increased need for wire-drawing dies, especially in radio equipment.[20] Another indication of the more extensive use of abrasive diamonds is the relative total weight of diamonds used for gems and for industrial purposes. Before the war, about 30 percent by weight was estimated as industrial diamonds. At present this percentage is variously estimated at 70 to 80 percent. The demand for industrials has become so strong that much of the smaller flawless stone normally marketed as gem material is being diverted to abrasive purposes or to be used as dies. Improved methods of crushing and sieving also have resulted in much finer and more uniform sizes of diamond dust, even down to 1 micron in diameter. Diamond dust in these finer sizes now is vitally important in polishing operations in war industries, particularly in the manufacture of precision lenses and in imparting supersmooth finish to bearings.[21]

A good account of the role of diamonds and natural and artificial sapphires and rubies in present-day industry was published.[22] A comprehensive summary of the diamond industry was published in 1943.[23] The extremely active market for both gems and industrial stones was discussed by countries of output and by markets where sold. An appraisal of the position of the Allied Nations and the Axis countries was made with respect to the relative abundance or scarcity of supplies currently available for use in war production. The use of diamonds in blast-hole mining and pillar recovery is increasing and consumption for diamond-set tools and diamond dies is greater than heretofore. Likewise, the use of crushing bort in bonded wheels and other tools and diamond dust for grinding vital parts of radio and radar equipment has increased greatly.

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[17] Mitchell, S. L., Emery—Its Occurrence and Characteristics: Chem. Eng. and Min. Rev. (Melbourne) vol. 36, No. 425, February 10, 1944, pp. 121-23.

[18] See also chapter on Gem Stones of this volume.

[19] The Mining Journal, vol. 222, No. 5655, January 8, 1944, pp. 23-24.

[20] War Production Board Press Release, August 3, 1943.

[21] Jacobson, Henry I., Diamond Price Structure Firm: National Jeweler, July 1943, pp. 134, 136.

[22] Kraus, Edward H., Luxury to Utility, the Place of Gem Stones in War Industry: Reprint from Michigan Alumnus Quarterly Review, vol. 49, No. 24, July 24, 1943, pp. 331-336.

[23] Ball, Sydney H., The Diamond Industry in 1942: Min. Jour., vol. 221, No. 5646, November 6, 1943, pp. 545-546; No. 5647, November 13, 1943, pp. 559-561; No. 5648, November 20, 1943, pp. 575-576 (abstract from The Jewelers' Circular-Keystone).

ARTIFICIAL ABRASIVES

The expanded industrial output, particularly of munitions, ships, planes, and other war matériel, resulted in substantial increases in the production and sales of aluminum oxide, silicon carbide, and metallic abrasives. Both the combined total output of manufactured abrasives and each class individually established records in 1943 for the third successive year. Although the capacity of plants to produce was substantially increased during the year, operation, as in other recent years, continued at virtually the maximum possible for both silicon carbide and aluminum oxide (98 percent of capacity). Production of silicon carbide in 1943 was 13 percent higher and of aluminum oxide 18 percent higher than in 1942. Operating at about 73 percent of capacity, manufacturers of metallic abrasives (steel shot and grit) increased their shipments 17 percent in 1943 compared with 1942.

Crude artificial abrasives sold, shipped, or used, from manufacturing plants in the United States and Canada, 1939–43

Year	Silicon carbide [1]		Aluminum oxide [1]		Metallic abrasives [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	24,206	$1,713,207	50,468	$3,047,337	42,015	$1,743,859	116,689	$6,504,403
1940	33,042	2,359,876	98,531	5,464,986	50,016	2,317,829	181,589	10,142,691
1941	44,962	3,325,928	147,759	9,067,732	86,309	4,050,659	279,030	16,444,319
1942	61,681	4,904,309	183,633	12,719,337	[3] 106,442	[3] 5,618,913	[3] 351,756	[3] 23,242,559
1943	69,706	5,912,590	217,425	13,202,270	124,954	7,083,141	412,085	26,198,001

[1] Production; Bureau of Mines not at liberty to publish data for United States separately. Figures include material used for refractories and other nonabrasive purposes.

[2] Figures include only shipments from United States plants.

[3] Revised figures.

Production of silicon carbide and aluminum oxide is concentrated largely in the Niagara Falls region of Canada and the United States; some aluminum oxide, however, is produced in Quebec (Canada) and in Alabama. The same companies that produced aluminum oxide and silicon carbide in 1942 and other recent years were active in 1943. Included in the total for aluminum oxide in 1943 is 28,127 tons of the type designated as "white high purity or special," valued at $3,191,768. Increased consumption of silicon carbide in refractories is reflected in the estimated 41 percent of total production used for nonabrasive or refractory purposes in 1943, compared with 35 percent in 1942, 32 percent in 1941 and 1940, and 29 percent in 1939. Similar data for aluminum oxide indicate much lower percentages of total output employed for nonabrasive or refractory purposes—4 percent in 1943, 3 percent in 1942 and 1941, 2 percent in 1940, and 4 percent in 1939.

Statistics for metallic abrasives cover steel shot and grit (including figures for one firm that manufactures a similar product from salvaged wire clippings) but not steel wool. In 1943, metallic abrasives were manufactured in Massachusetts, Michigan, New Hampshire, Ohio (the chief producing State), and Pennsylvania. Twelve companies with 13 plants reported shipments in 1943, compared with 8 companies and 9 plants in 1942. Two new plants, one in Illinois and one in New York, were scheduled to begin operations early in 1944.

On the occasion of his acceptance of the Jacob F. Schoellkopf medal, Ridgway traced the development of the manufacture of aluminous artificial abrasives.[24] He particularly stressed the physico-chemical reactions in electric-furnace production of fused aluminum oxide and described the methods of manufacture of grain and molded forms of boron carbide and the industrial applications for which they are especially suited. Modern methods of using abrasive grains, particularly aluminum oxide and silicon carbide, were described by Heywood,[25] who presents a good practical discussion of polishing, flexible grinding and buffing methods, lapping with abrasive grain, use of grain in the glass and optical industries, and various miscellaneous uses. Suggested grain sizes of various types of abrasives applicable to specific grinding, polishing, and lapping operations based on actual experience are given in the text and in tabular form. The manufacture and grading of abrasives and standardization of sieve sizes were discussed by Walton.[26] Methods were described for reclaiming abrasive grain from polishing refuse,[27] and for separating an impure crystalline alumina from its adhering slag to recover abrasive crystal values.[28]

MISCELLANEOUS MINERAL ABRASIVE MATERIALS

In addition to the natural and manufactured abrasive materials herein discussed, many other mineral substances are used for abrasive purposes. Various oxides, including tin oxide, rouge, crocus, chromium oxide, magnesium oxide, and manganese oxide, are utilized as polishing agents. Among manufactured or artificially prepared products used or intended for use as abrasives are boron carbide, a periclase abrasive made from magnesite, a product made by fusing quartz with a mixture of magnesia and magnesium chloride (reported from Costa Rica),[29] and an abrasive consisting of a mixture of powdered metal and crushed diamond bort (developed by South African scientists).[30] Finely ground as well as calcined clays, high-grade lime, talc, river silt, slate flour, whiting, feldspar, and other substances also are used as abrasives.

FOREIGN TRADE [31]

Stimulated by the need for grinding wheels for tool steels and polishing media for lenses and other precision instruments, imports of corundum in 1943 increased 20 percent in tonnage and 28 percent in value over 1942 and were only 3 percent under the high year, 1941. Imports of ground, pulverized, or refined corundum and emery grain, however, nearly doubled in 1943 compared with 1942. (Although not shown separately, the bulk of this item probably is corundum grain.) No imports of emery ore were reported in 1943. Receipts of crude pumice remained at a low level, and no pumice "manufactures" were listed. Imports of tripoli and rottenstone were insignificant. "Flint, flints and flint stones, unground" imports in 1943 were somewhat higher than in 1942 but were still considerably under those of other recent years. Imports of industrial diamonds, comprised largely in the classification "glaziers', and engravers', unset, and miners' diamonds," rose 8 percent above the exceptionally large receipts of 1942, although the average value per carat declined. This lower value reflects the current trend toward the use of smaller diamonds in impregnated or bonded cutting and grinding tools and for other purposes. A very large increase in imports of diamond dust was indicated in 1943.

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[24] Ridgway, Raymond R., Manufactured Abrasives—Old and New: Chem. and Eng. News (Am. Chem Soc.), vol. 21, No. 11, June 10, 1943, pp. 858–861.

[25] Heywood, Johnson, Abrasive Grains and Their Uses: Published under the auspices of the Abrasive Grain Association, by Penton Publishing Co., Cleveland, Ohio, 1943, 73 pp.

[26] Walton, S. F., Story of Abrasives: Monthly Rev. Am. Electroplaters' Soc., vol. 27, 1940, pp. 841–851; Chem. Abs., vol. 35, 1941, p. 2290; Ceram. Abs. (Am. Ceram. Soc.), vol. 22, No. 8, August 15, 1943, p. 131.

[27] Alexander, J., Reclaiming Abrasive Grain: Am. Machinist, vol. 86, No. 23, 1943, pp. 1345–1346; Ceram. Abs. (Am. Ceram. Soc.), vol. 22, No. 5, May 15, 1943, p. 65.

[28] Ridgway, Raymond R., Purifying Crystalline Alumina, as for Use as an Abrasive: U. S. Patent 2,301,706, (assigned to Norton Co.) November 10, 1942; Chem. Abs., vol. 37, No. 8, April 20, 1943, p. 2146.

[29] Foreign Commerce Weekly, vol. 14, No. 4, January 22, 1944, p. 27.

[30] Foreign Commerce Weekly, vol. 13, No. 11, December 11, 1943, p. 26.

[31] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

The total value of exports of natural abrasive materials in 1943 declined 47 percent compared with 1942 but was 10 percent above 1941. Each class of exports of abrasive shown in the accompanying table had a value less than in 1942—grindstones, only 5 percent; emery and corundum abrasive wheels, 64 percent; and all other natural abrasives and abrasive products, 28 percent.

Abrasive materials imported for consumption in the United States, 1941–43, by kinds

Kind	1941		1942		1943	
	Quantity	Value	Quantity	Value	Quantity	Value
Burrstones: Bound up into millstones short tons..	12	$685	2	$153	16	$1, 204
Grindstones, finished or unfinished short tons..	511	14, 745	491	17, 719	295	11, 130
Hones, oilstones, and whetstones short tons..	22	41, 168	48	59, 196	4	20, 039
Emery:						
Grains, ground, pulverized, or refined pounds..	(1)	(1)	(1)	(1)	(1)	(1)
Paper and cloth of emery or corundum..	(2)	165, 544	(2)	156, 846	(2)	76, 193
Wheels, files, and other manufactures of emery or corundum or garnet pounds..	786	476	5, 757	1, 329	211, 198	108, 018
Corundum (see also "Emery"):						
Ore.......................short tons..	5, 865	287, 102	4, 739	260, 783	5, 686	333, 209
Grains, ground, pulverized, or refined pounds..	[1] 102, 906	[1] 4, 021	[1] 124, 362	[1] 7, 001	[1] 245, 060	[1] 12, 927
Tripoli and rottenstone........short tons..	431	9, 116	231	4, 826	6	268
Pumice: Crude or unmanufactured....do..	43	987	67	1, 391	33	1, 155
Diamond:						
Bort.............................carats..	502	16, 196	2, 249	27, 458	1. 512	26, 376
Dust.............................do......	(3)	2, 805	1, 050	776	89, 785	74, 309
Glaziers' and engravers', unset, and miners'........................carats..	6, 882, 248	14, 908, 809	11, 203, 704	22, 057, 577	12, 083, 394	21, 864, 059
Flint, flints, and flint stones, unground.... short tons..	1, 467	18, 494	376	5, 683	484	7, 165
	....	15, 470, 148	....	22, 600, 738	....	22, 536, 052

[1] Emery included with corundum; not separately classified.
[2] 2,975 reams in 1941, 1,787 reams in 1942, 1,788 reams in 1943; weight not recorded.
[3] Quantity not recorded.

Value of domestic abrasive materials exported from the United States, 1939–43

Material	1939	1940	1941	1942	1943
Grindstones..	$173, 575	$215, 156	$187, 621	$224, 998	$213, 170
Abrasive wheels, emery and corundum..............	125, 303	179, 514	144, 393	3, 665, 386	1, 334, 654
All other natural abrasives, whetstones, hones, etc...	1, 116, 711	1, 211, 291	2, 887, 628	2, 793, 968	2, 002. 704
	1, 415, 589	1, 605, 961	3, 219, 642	6, 684, 352	3, 550, 528

SULFUR AND PYRITES

By G. W. Josephson and M. S. Jensen[1]

SUMMARY OUTLINE

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GENERAL SUMMARY

For widely varying reasons, world production of native sulfur decreased sharply in 1943. During the year Sicily was at the edge or at the center of a battle zone—a condition that reduced sulfur production to negligible proportions. In the United States past years of record-breaking output had accumulated such stock piles that in spite of an increase in consumption operators were able to throttle back production to a rate that would gradually reduce these stocks.

As the submarine menace was brought under control more bottoms were assigned to the transportation of sulfur. Consequently exports increased, relieving shortages in various Allied and neutral countries. This development tended to ease the search for domestic sources in many, but not all, importing countries. Notable exceptions are Argentina, which is turning to its native sulfur deposits, and Great Britain, which continued its investigation of coal byproducts.

The status of pyrites production in 1943 is clouded by lack of authentic information from Axis-dominated areas. Output in Spain, Portugal, and Cyprus is curtailed in varying degree by shipping restrictions. Rumors indicate that Germany is suffering an acid shortage, but it is not clear that the cause is deficiency in raw materials. Although many countries that formerly purchased pyrites from Spain and other exporters have succeeded in finding alternative sources, total world production in 1943 probably was somewhat below a record level.

In the United States prices of sulfur and acids were comparatively stable, and with minor exceptions, the Office of Price Administration continued the General Maximum Price Regulation. Such an ample supply of sulfur was available that the War Production Board found allocation unnecessary. However, more difficulty was encountered in supplying the demand for sulfuric acid, and it was placed under allocation in the last part of the year.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

POST-WAR OUTLOOK

Satisfactory progress in the war has focused attention on post-war problems. Some concern is evident among the acid producers because of the substantial increase in sulfuric acid production capacity since 1939. Undoubtedly, some obsolete and some war-born acid plants will be unable to find profitable peacetime markets in their shipping areas, and competition may be very active, even in the best markets. Recovery of byproduct sulfur compounds from oil refining and acid sludges gradually may make the petroleum industry more self-sufficient; on the other hand, some believe that future production methods may require the purchase of even greater quantities of sulfur. Competitive materials having particularly advantageous properties occasionally threaten to usurp important markets—for example, hydrofluoric acid in oil refining—but even here sulfuric acid appears capable of defending its position.

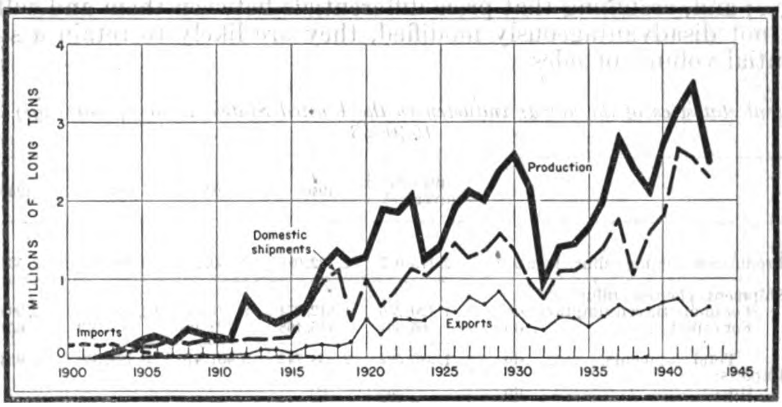

FIGURE 1.—Domestic production, shipments for domestic consumption, exports, and imports of crude sulfur, 1900–1943.

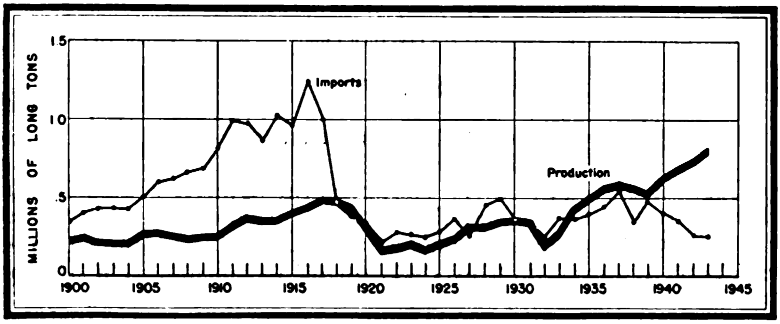

FIGURE 2.—Domestic production and imports of pyrites, 1900–1943.

Fortunately the industry has a very solid foundation in the fact that sulfuric acid costs substantially less than the next cheapest mineral acid. As in past years, the technical literature indicates that new products and methods are enlarging rather than limiting the sulfur market. As the curve of acid consumption closely approximates that of business activity, the market will be determined largely by the degree of general prosperity attained.

In any case, the position of the domestic native sulfur industry appears to be assured. During the past few years the United States has come to depend more and more completely on native sulfur rather than on imported or even domestic pyrites. On the other hand, domestic and imported pyrites have local competitive advantages; and, assuming that price differentials between them and sulfur are not disadvantageously modified, they are likely to retain a substantial volume of sales.

Salient statistics of the sulfur industry in the United States, 1935–39 (average) and 1940–43

	1935–39 (average)	1940	1941	1942	1943
Sulfur:					
Production of crude sulfur..long tons..	2,175,057	2,732,088	3,139,253	3,460,686	2,538,786
Shipments of crude sulfur:					
For domestic consumption..do....	1,420,236	1,812,274	2,671,946	[1] 2,560,310	2,299,452
For export....................do....	566,361	746,468	729,464	568,249	654,393
Total shipments..........do....	1,986,597	2,558,742	3,401,410	3,128,559	2,953,845
Imports:					
Ore.........................do....	555	([2])	----------	----------	----------
Other.......................do....	3,427	27,845	28,631	25,632	16,658
Exports of treated sulfur........do....	16,374	19,745	31,312	17,030	28,079
Producers' stocks at end of year..do....	3,560,000	4,200,000	3,900,000	4,300,000	3,800,000
Price of crude sulfur f. o. b. mines per long ton..........................	$17.40	$16	$16	$16	$16
Pyrites:					
Production.................long tons..	544,144	626,640	645,257	720,363	802,384
Imports..........................do....	433,485	407,004	368,838	300,140	256,308
Price of imported pyrites c. i. f. Atlantic ports..cents per long-ton unit..	12–13	12–13	12	[3] 12	14
Sulfuric acid: Production of byproduct sulfuric acid (60° B.) at copper, lead, and zinc plants.................short tons..	727,172	840,937	915,989	960,764	1,195,707

[1] Revised figure. [2] Less than 1 ton. [3] Nominal.

SULFUR

DOMESTIC PRODUCTION

Production of crude native sulfur in the United States in 1943, conducted at a rate calculated to reduce producers' stocks, was 27 percent below the record tonnage attained in 1942. Mine shipments were 6 percent lower than in 1942, owing to consumption of stocks accumulated in previous years at other locations. In addition to the tonnage of relatively pure crude sulfur reported as the United States total, a comparatively small amount of native sulfur-bearing ore, containing 10 to 50 percent sulfur, was mined in Texas (3,500 long tons) and Colorado and sold for agricultural purposes.

REVIEW BY STATES

Texas contributed 75 percent and Louisiana 25 percent of the native sulfur mined in the United States in 1943. California and Utah reported no production.

Sulfur produced and shipped in the United States, 1939–43

Year	Produced (long tons)				Shipped	
	Texas	Louisiana	Other States [1]	Total	Long tons	Approximate value
1939	1,665,400	422,600	2,979	2,090,979	2,233,817	$35,500,000
1940	2,212,839	512,935	6,314	2,732,088	2,558,742	40,900,000
1941	2,596,731	533,620	8,902	3,139,253	3,401,410	54,400,000
1942	2,885,621	570,345	4,720	3,460,686	3,128,559	50,100,000
1943	1,908,581	630,205	....	2,538,786	2,953,845	47,300,000

[1] 1939–40 and 1942: California and Utah; 1941: California.

Colorado.—Thomas Sulphur Co. mined sulfur ore in Delta County.

Louisiana.—Output from the Grande Ecaille mine of the Freeport Sulphur Co., Plaquemines Parish, increased to 630,205 long tons in 1943.

Texas.—The following companies operated in Texas in 1943: Duval Texas Sulphur Co., at Orchard Dome, Fort Bend County; Freeport Sulphur Co., at Hoskins Mound, Brazoria County; Jefferson Lake Sulphur Co., Inc., at Clemens Dome, Brazoria County; Texas Gulf Sulphur Co., at Boling Dome, Wharton County; and the Pecos Orla Sulphur Co. mined sulfur ore at the Michigan claims in Culberson County. It is reported that the Jefferson Lake Sulphur Co. is preparing to start production from a dome in Fort Bend County when Clemens Dome is exhausted.

The following table was compiled from information issued by the Texas State Comptroller's Office.

Sulfur produced in Texas in 1943, by companies, in long tons

Company	First quarter	Second quarter	Third quarter	Fourth quarter	Total
Texas Gulf Sulphur Co	321,838	311,958	260,812	292,274	1,186,882
Freeport Sulphur Co	107,730	97,125	96,180	96,590	397,625
Jefferson Lake Sulphur Co., Inc	44,178	38,508	30,705	35,903	149,294
Duval Texas Sulphur Co	51,360	44,085	38,355	40,980	174,780
	525,106	491,676	426,052	465,747	1,908,581

RECOVERY AS BYPRODUCT

The total sulfur available in byproducts of industrial processes is very large; but most of this material is discarded, as only a fraction can be profitably recovered at present.

Copper and zinc ores and coal-mine wastes commonly contain large quantities of pyrites, and substantial tonnages are now concentrated and used in the manufacture of sulfuric acid. Such output is recorded in the Pyrites section of this chapter.

During smelting, concentrates of copper and zinc sulfides themselves give off sulfur dioxide and other sulfur-bearing gases, which are converted to sulfuric acid at many smelters. The equivalent of about 210,000 long tons of sulfur was recovered annually from this source during the five years ended in 1943. The following table shows the output of acid at copper-, lead-, and zinc-smelting plants.

Byproduct sulfuric acid [1] *(expressed as 60° B.) produced at copper and zinc plants in the United States, 1939–43, in short tons*

	1939	1940	1941	1942	1943
Copper plants [1]	249, 569	254, 025	243, 812	265, 522	348, 832
Zinc plants	528, 872	586, 912	672, 177	695, 242	846, 875
	778, 441	840, 937	915, 989	960, 764	1, 195, 707

[1] Includes sulfuric acid produced as byproduct at a lead smelter.

In addition to serving as a means of producing a profitable byproduct, recovery of sulfur or its compounds from coke-oven, refinery-still, natural, or other gases also provides more intangible benefits. Sulfurous gas is destructive to equipment and vegetation, and its removal often reduces plant-maintenance costs and eliminates a nuisance in the surrounding area. In 1943 the Ford Motor Co. installed a Thylox-process plant to produce sulfur from coke-oven gas.

Most of the elemental sulfur derived from gas purification comes from plants using the Thylox process; relatively small quantities are removed with the Ferrox and Nickel processes. Production in 1943 (in terms of 100 percent sulfur) total 5,101 long tons; 4,735 tons valued at $190,755 were shipped. Output came from Illinois, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, Washington, West Virginia, and Wisconsin; Massachusetts and New York were the largest producing States. Of the 1943 shipments (calculated as 100 percent sulfur), 41 percent was marketed in the form of paste containing 38 to 52 percent sulfur, and 59 percent was sold in dried relatively pure condition.

Fuel gases also yield hydrogen sulfide through the phenolate, phosphate, and Girbotol processes. In 1943 the hydrogen sulfide recovered contained 17,591 long tons of sulfur and came from plants in California, New Jersey, and Pennsylvania. Most of this material subsequently was converted into sulfuric acid.

The figures covering the byproduct yield of sulfur from gas purification are not included in the sulfur-production figures for the United States.

STOCKS

During 1943 the total of producer-owned stocks declined 13 percent to 4,462,000 long tons. At the end of the year 3,841,000 long tons were held at the mines and the remainder at consumption centers or in transit.

PRICES

Throughout 1943 crude sulfur was quoted by trade journals at $16 per long ton f. o. b. mines and sulfuric acid, 66° B., at $16.50 per short ton at works in tank cars. The Office of Price Administration contemplated issuing a fixed schedule of prices for sulfuric acid; but, after a detailed study revealed a stable price situation, action was withheld. An independent investigation by the Bureau of Labor Statistics, United States Department of Labor, showed that average acid prices were the same in 1943 as in 1939. As many of their costs have risen, some acid producers found themselves in an unfavorable position. Limited relief was granted such manufacturers on certain long-term contract sales.

Although demand was at record levels, information from the industry indicates that the trend of sulfur prices is down.

CONSUMPTION AND USES

Consumption of sulfur in the United States attained a new record in 1943. The 2-percent increase indicated in the following table, showing apparent domestic consumption during the past 5 years, may be slightly low, as it does not allow for the comparatively small tonnage believed to have been withdrawn by consumers from stock piles they have accumulated in previous years.

Apparent consumption of sulfur in the United States, 1939–43, in long tons

	1939	1940	1941	1942	1943
Shipments [1]	2,233,817	2,558,742	3,076,038	3,032,043	3,191,051
Imports	13,976	27,845	28,631	25,632	16,658
	2,247,793	2,586,587	3,104,669	3,057,675	3,207,709
Exports:					
Crude	627,819	746,468	729,464	568,249	654,393
Refined	25,005	19,745	31,312	17,030	28,079
	652,824	766,213	760,776	585,279	682,472
Apparent consumption	1,594,969	1,820,374	2,343,893	[2] 2,472,396	2,525,237

[1] 1939–40: Mine shipments; 1941–43: Apparent shipments to consumers.
[2] Revised figure.

The pattern of industrial sulfur consumption has been estimated by Chemical and Metallurgical Engineering as follows:

Sulfur consumed in the United States, 1939–43, by uses, in long tons

Use	1939	1940	1941	1942	1943
Chemicals	695,000	800,000	[1] 1,060,000	[1] 1,260,000	[1] 1,320,000
Fertilizer and insecticides	370,000	410,000	450,000	475,000	500,000
Pulp and paper	240,000	320,000	360,000	365,000	305,000
Explosives	64,000	74,000	[1] 83,000	[1] 90,000	[1] 90,000
Dyes and coal-tar products	46,000	51,000	65,000	60,000	65,000
Rubber	43,000	47,000	55,000	35,000	45,000
Paint and varnish	49,000	54,000	65,000	70,000	80,000
Food products	6,000	6,000	6,000	6,000	7,000
Miscellaneous	82,000	86,000	95,000	110,000	120,000
	1,595,000	1,848,000	2,239,000	2,471,000	2,532,000

[1] To avoid disclosing estimated consumption of sulfur in direct defense applications, such as military explosives, sulfur so used in 1941–43 is included under "Chemicals."

Over three-fourths of the sulfur, from all sources, consumed in the United States is converted into sulfuric acid before entering its final use. Production of sulfuric acid is estimated to have expanded from 12,520,000 short tons (calculated as 50° B.) in 1942 to 13,930,000 short tons in 1943, or 11 percent.[2]

Chemical and Metallurgical Engineering has estimated the consumption of sulfuric acid, by industries, from 1939 through 1943 as follows:

Sulfuric acid (expressed as 50° B.) consumed in the United States, 1939–43, by industries, in short tons

Industry	1939	1940	1941	1942	1943
Fertilizer	1,970.000	2,260,000	2,500,000	2.950.000	4,100,000
Petroleum refining	1,210,000	1,260.000	1.400,000	1.650,000	1.720.000
Chemicals	975,000	1.120.000	[1] 1.790,000	[1] 2,250,000	[1] 2.350.000
Coal products	740,000	900.000	940,000	970,000	927,000
Iron and steel	980.000	1.300.000	1.500,000	1,600.000	1,650,000
Other metallurgical	570.000	640,000	800,000	840,000	860.000
Paints and pigments	520,000	580,000	700,000	760,000	800,000
Explosives	160,000	170.000	[1] 190,000	[1] 195.000	[1] 190,000
Rayon and cellulose film	405,000	470.000	555.000	625.000	635.000
Textiles	116.000	125.000	165,000	145,000	135,000
Miscellaneous	384,000	360,000	500.000	530.000	550,000
	8,030,000	9,185,000	11,040,000	12,515,000	13,917,000

[1] To avoid disclosing estimated consumption of acid in direct defense applications, such as military explosives, acid so used in 1941-43 is included under "Chemicals."

Whereas most industries made modest increases and a few equally modest decreases, the big expansion in demand was found in the fertilizer industry, which used 39 percent more sulfuric acid than the record attained in 1942. Wartime food requirements and high farm income combined to drive superphosphate sales to unprecedented heights. Nor was the end in sight. At the year end, seven new fertilizer plants were scheduled for construction during 1944. The over-all 11-percent increase in acid consumption was not beyond the capabilities of installed plant capacity; but some areas, particularly in the West, were inadequately supplied owing in part to transportation difficulties. Shipments of fertilizer-grade acid from ordnance plants were also smaller than expected. Construction of additional plants in the shortage areas was contemplated.[3]

FOREIGN TRADE

In 1943 the shipping situation improved, allowing the export of 15 percent more crude and 65 percent more treated sulfur than in 1942. The following table shows the distribution, by countries, of our wartime sulfur exports.

The comparatively minor quantity of elemental sulfur imported into the United States comes principally from Canada. Canada also supplied 32,315 short tons of sulfuric acid, whereas exports from the United States totaled only 4,558 short tons.

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[2] Chemical and Metallurgical Engineering, Sulphuric Acid and Sulphur: Vol. 51, No. 2, February 1944, p. 111.

[3] Chemical and Metallurgical Engineering, vol. 51, No. 2, February 1944, p. 111.

Sulfur exported from the United States, 1942–43, by countries

Country	Crude				Crushed, ground, refined, sublimed, and flowers of			
	1942		1943		1942		1943	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
North America:								
Canada	297,705	$6,245,764	208,762	$4,717,768	8,151,119	$224,702	7,676,983	$216,156
Central America	84	3,294	96	3,756	589,188	14,403	881,896	27,364
Mexico	4,489	87,863	2,488	55,494	3,907,260	73,970	2,876,962	62,779
Newfoundland and Labrador	14,822	311,930	2,425	40,013	4,500	207	4,000	191
West Indies	12,247	212,721	15,201	262,859	370,377	16,878	499,741	18,850
Other North America					510	44	1,480	73
	329,347	6,861,572	228,972	5,079,890	13,022,954	330,204	11,941,062	325,413
South America:								
Argentina	16,338	294,975	24,160	473,775	145,753	15,709	2,001,018	29,387
Brazil	16,582	333,984	26,141	579,519	4,198,350	92,668	9,092,138	253,366
Chile					268	24	11,771	603
Colombia	230	4,913	497	12,016	716,494	19,614	689,821	20,838
Ecuador			4	272	39,580	1,261	25,794	788
Peru					113,120	3,177	285,227	7,654
Uruguay	1,224	39,368	4,232	98,118	693,444	13,875	2,773,800	67,753
Venezuela	20	501			109,298	2,938	125,574	3,464
Other South America			175	4,872	16,393	482	22,924	1,004
	34,394	673,741	55,209	1,168,572	6,032,700	149,748	15,028,067	384,857
Europe:								
Eire					103,400	2,328	427,795	9,426
Malta, Gozo, and Cyprus Islands							269,570	6,455
United Kingdom [1]	121,807	1,888,005	254,894	4,064,231	3,126,884	76,624	6,770,250	62,678
Other Europe							40	6
	121,807	1,888,005	254,894	4,064,231	3,230,284	78,952	7,467,655	78,565
Asia:								
British Malaya					66,352	995		
Burma					112	39		
Ceylon			11	625	401,631	10,297	1,311,330	32,804
China					2,500	1,013	7,500	3,038
India and Dependencies	11,028	273,210	24,649	546,998	8,246,626	223,278	11,634,688	218,261
Iran	4,281	86,864	11,159	227,157	3,997,000	36,450	455,400	4,948
Netherlands Indies					178,350	3,978		
Palestine and Trans-Jordan	2,300	46,625	3,250	65,713			449,010	10,188
Other Asia			4,218	102,208	1,800	382	30,015	2,421
	17,609	406,699	43,287	942,701	12,894,371	276,432	13,887,943	271,660
Africa:								
Algeria							11,318,605	260,481
Belgian Congo					491,312	12,093	329,635	10,927
British East Africa			297	14,759	700,752	17,509	2,239,596	57,177
Egypt	1,450	29,338	150	4,758	355,582	7,530	12,782	751
Madagascar							44,000	1,210
Mozambique	150	3,555	100	2,250				
Nigeria	3	77			32,535	1,057	101,081	3,651
Union of South Africa	17,992	318,032	20,850	352,816	1,103,514	28,689	338,860	28,333
Other Africa			5	198	3,709	195	10,928	566
	19,595	351,002	21,402	374,781	2,687,404	67,073	14,395,487	363,096
Oceania:								
Australia	28,323	481,010	25,160	425,518	49,239	1,703	138,815	4,761
New Zealand	17,174	280,674	25,469	419,309	229,739	7,416	34,964	2,030
Other Oceania					1,360	70	2,060	140
	45,497	761,684	50,629	844,827	280,338	9,189	175,839	6,931
	568,249	10,942,703	654,393	12,475,002	38,148,051	911,598	62,896,053	1,430,522

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[1] United Kingdom of Great Britain and Northern Ireland.

Sulfur imported into and exported from the United States, 1939–43

Year	Imports				Exports			
	Ore		In any form, n. e. s.		Crude		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1939	35	$445	13,941	$250,422	627,819	$10,771,751	25,005	$909,974
1940	(1)	5	27,845	473,052	746,468	13,041,911	19,745	780,968
1941			28,631	487,758	729,464	12,520,068	31,312	1,360,683
1942			25,632	442,811	568,249	10,942,703	17,030	911,598
1943			16,658	43,083	654,393	12,475,002	28,079	1,430,522

[1] Less than 1 ton.

WORLD PRODUCTION

Although few official statistics are available, it is apparent that total world production of elemental sulfur declined sharply in 1943 and, even including that derived from gases, probably did not exceed 3,200,000 long tons. For widely different reasons the two main producing countries—the United States and Italy—failed to maintain the pace set in 1942.

World production of native sulfur, 1937–43, by countries, in long tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina					367	2,707	11,810
Bolivia (exports)	1,712	1,632	2,126	4,065	2,315	3,535	7,079
Chile [2]	16,766	20,959	26,999	28,997	24,784	30,000	(3)
Ecuador	54	68	72	(3)	(3)	(3)	(3)
France (content of ore)	157	140	(3)	(3)	(3)	(3)	(3)
Greece	67	75	(3)	(3)	(3)	(3)	(3)
Guatemala	11	15	12	11	(3)	(3)	(3)
Italy (crude)[4]	338,101	374,339	(3)	(3)	(3)	(3)	(3)
Japan	138,283	(3)	(3)	(3)	(3)	(3)	(3)
Mexico	(3)	49	(3)	(3)	(3)	(3)	[5] 2,194
Netherlands East Indies	12,474	15,986	17,293	16,908	(3)	(3)	(3)
Palestine	494	1,196	829	1,248	(3)	(3)	(3)
Peru	1,551	1,944	569	610	923	[5] 875	[5] 295
Spain [6]	940	990	3,770	3,560	6,230	5,000	(3)
Turkey	2,229	3,684	2,560	(3)	(3)	(3)	(3)
United States	2,741,970	2,393,408	2,090,979	2,732,088	3,139,253	3,460,686	2,538,786
Estimated world total	3,300,000	3,000,000	2,700,000	3,300,000	3,700,000	4,000,000	3,000,000

[1] Native sulfur believed to be produced also in China, Cuba, India, Iran, Taiwan, and U. S. S. R., but quantity unknown.

[2] In addition, 1,050 tons of sulfur rock (40–80 percent sulfur) reported for 1937.

[3] Data not available.

[4] In addition, following quantities of sulfur rock reported—1937: 19,793 tons; 1938: 16,545 tons. Similar data not available for later years.

[5] Exports.

[6] Estimated sulfur content of ore, excluding sulfur made from pyrites.

Argentina.—Argentina has taken measures intended to make the country self-sufficient in sulfur in the relatively near future. In August 1943 the Government formed a mixed corporation with Compañía Azufrera Argentina S. A., principal Argentine sulfur producer. The new corporation, Industrias Quimicas Nacionales, S. M., receives a third of its financial backing, exclusive prospecting rights, and assistance in marketing from the Government. Present annual consumption of sulfur in Argentina is said to be about 30,000 tons, and the expectation is that the present refining capacity of 12,000 tons a year is to be enlarged sufficiently to supply the entire domestic market. Prices are now about 350 pesos a ton, but the new company has contracted to deliver at 250 pesos, and it is hoped that Argentine sulfur can be sold for 150 pesos after the refining plant has been expanded, production methods improved, and transportation cost reduced. The pre-war price of imported sulfur was 130 pesos per ton.

The sulfur deposits are in the Provinces of Mendoza and Salta (formerly in the Territory of Los Andes) near the Chilean border. At present production is coming from a single mine, the Cerro Estrella, about 100 kilometers south of Socompa. Mine-run material is carried by trucks 10 miles to the refinery, and the refined sulfur 80 miles to railhead. The deposit is said to contain 8 million tons of ore averaging 60 percent sulfur.

Chile.—In 1943 the Chilean sulfur industry enjoyed a great advantage in the South American market, as competition was restricted by war conditions. Demand was active, and it was reported that prices advanced from $50 to $75 and even to $100 per ton. Apparently consumers considered prices to be excessive, and demand was reduced to a point that caused considerable concern. An association was formed through which producers could cooperate in solving common problems. It is widely believed that Chilean producers must improve their processes and reduce prices to continue in business on a substantial and permanent basis. Reduction of the high cost of transportation will be difficult, though not impossible. The purity of the Chilean product, which has always suffered by comparison with the American, may be improved by a method, now being tried on a pilot-plant scale, by which impurities are agglomerated by treatment with sulfuric acid and subsequently filtered or settled out. At present Chile consumes only 6,000 to 8,000 tons of sulfur a year, so the industry must look for most of its volume in the foreign market. More than 220 sulfur properties have been listed. The three principal producers are: Compañía Azufrera del Pacifico, Tacora; Compañía Azufrera Alcanquilcha, Ollague; and Luis Borlando, Buenaventura, Ollague.[4]

Mexico.—Sulfur has been produced in Mexico for several hundred years, but the industry has never achieved major stature. The greatest annual output on record is 9,600 tons, obtained in 1912 from deposits in the State of San Luis Potosí. At present approximately 300 to 400 tons of crude sulfur are produced monthly, largely from the vicinity of Mexicali in northern Lower California. Occurrences of sulfur have been reported from at least 18 States of the Republic, but most of them are too small to support large-scale operations.[5]

Sicily.—Evidence accumulates that this war has fallen far short of benefiting Sicily's sulfur industry. The following production statistics, in long tons, tell a story of steady decline: 1939, 211,328; 1940, 198,192; 1941, 150,368; and 1942, 93,980. The number of mines dropped from about 100 in 1939 to 74 in 1942, and prices advanced from 584 lire in 1940 to 800 lire in 1942 and finally to 1,500 lire just before the invasion. Output in 1943 apparently was negligible. During the first 6 months of 1943 Sicily served principally as a base for Axis armies. Lack of electricity, shipping space, and necessary supplies made sulfur production nearly impossible, and when the invasion struck early in July operations ceased.

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[4] Mineral Trade Notes, Confidential Series 20, February 1944, pp. 39-45.

[5] See footnote 4.

Sicilian sulfur can be used to advantage in certain Mediterranean, European, and even Asiatic areas. Late in the year Allied authorities initiated a program intended to reactivate the industry. A price of 1,700 lire was established, and efforts were made to obtain supplies and power. The island is still in an exposed position in the war zone, but it is hoped that a minimum of 50,000 long tons of sulfur will be produced in the fiscal year 1943–44.[6]

Spain.—At present Spain is self-sufficient in elemental sulfur. Native sulfur produced by Industrial Quimica de Zaragoza, Coto Minero de Hellin, and Romero Hermanos de Almeria totals about 5,000 tons annually. The bulk of the elemental sulfur is supplied by the Rio Tinto Co. of Huelva, which has reached a yearly output of 27,000 tons derived from pyrites processed by the Orkla method. Spain's annual consumption requirements are estimated to be slightly over 30,000 tons, but with expansion of the rayon industry they are expected to increase to 55,000 tons.[7]

Turkey.—Production in Turkey is limited to about 4,000 tons of highly bituminous sulfur from the Keciburlu mine, and most of this material is unsuitable for refining. Turkey's sulfur requirements are estimated to be about 6,000 tons annually.

PYRITES

DOMESTIC PRODUCTION

As in the 3 previous years, production of pyrites in the United States attained a new record in 1943, exceeding the 1942 total by 11 percent. Nearly all (96 percent) of the domestic pyrites output in 1943 was classified as fines and the remainder as lump.

Pyrites (ores and concentrates) produced in the United States, 1939–43

Year	Quantity: Gross weight (long tons)	Quantity: Sulfur content (percent)	Value
1939	519,497	42.3	$1,560,000
1940	626,640	41.8	1,920,000
1941	645,257	41.9	2,009,000
1942	720,363	42.6	$2,464,000
1943	802,384	40.9	2,844,000

Most domestic pyrites are consumed by the producing companies. Whereas in 1942 the producers sold 234,639 long tons and converted 492,720 into other products, in 1943 they marketed 202,774 tons and consumed 591,779.

REVIEW BY STATES

California.—Virtually all the pyrites recovered in California in 1943 came from the Hornet mine of the Mountain Copper Co., Shasta County.

Colorado.—Five organizations contributed to the 15,215-ton Colorado total in 1943: Minnesota Mines, Inc., Clear Creek County; Rico Argentine Mining Co., Dolores County; Wilfley Leasing Co., Summit County; Axel Lind, Lake County; and The Ore & Chemical Corporation, Lake County.

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[6] Information furnished by Foreign Economic Administration.

[7] Mineral Trade Notes, Confidential Series 21, March 1944, pp. 33-37.

Illinois.—The Midland Electric Coal Corporation produced 12,968 tons of pyrites (coal brasses) in Henry County in 1943.

Indiana.—The Snow Hill Coal Corporation shipped 3,906 long tons of pyrites (coal brasses) from its Talleydale mine in Vigo County, in 1943.

Montana.—Pyrite recovery in Montana in 1943 was limited to the flotation concentrates produced by Anaconda Copper Mining Co. as a byproduct at its copper-plant operations at Anaconda.

New York.—In 1943 New York produced 62,907 long tons of pyrites.

Pennsylvania.—The Bethlehem Steel Co. produced pyrites in Lebanon County.

Tennessee.—As usual, the output of the Tennessee Copper Co. in the Ducktown Basin, Polk County, made Tennessee the leading pyrites-producing State. These flotation concentrates are not sold as such but are converted into other products before being marketed.

Virginia.—In recent years pyrites have been produced in Virginia only by General Chemical Co., at the Gossan mine, Carroll County, and consumed by the company in its acid plant at Pulaski.

Wisconsin.—The Vinegar Hill Zinc Co. recovered a substantial tonnage of pyrites as a flotation concentrate in Grant County from ores produced at mines in the Platteville district.

FOREIGN TRADE

Owing to the elimination of one of the Canadian mines that has been replacing Spanish sources since 1939, imports from Canada were 30 percent lower than in 1942. Imports from Spain increased somewhat, so the over-all reduction was only 15 percent. At the year end the lost capacity had not been replaced in Canada.

Although Spanish pyrites were variously quoted in the trade journals from 12 to possibly 20 cents per long-ton unit of sulfur, c. i. f. United States ports, actual realization, limited by comparable prices of Canadian pyrite, was approximately 14 cents per unit.

Pyrites, containing more than 25 percent sulfur, imported into the United States, 1939–43, by countries

Country	1939		1940		1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Canada	176,804	$470,336	81,157	$560,476	244,287	$1,151,964	282,897	$1,313,295	197,750	$683,110
Greece	22,800	106,271	--------	--------	--------	--------	--------	--------	--------	--------
Mexico	--------	--------	203	719	320	1,500	682	2,995	273	916
Spain	282,732	738,439	325,644	790,172	124,231	326,052	16,561	43,866	58,285	147,533
	482,336	1,315,046	407,004	1,351,367	368,838	1,479,516	300,140	1,360,156	256,308	831,559

Over 88 percent of the pyrites imported enters through various eastern customs districts and is consumed in sulfuric-acid plants principally in the Baltimore and Philadelphia areas.

Pyrites, containing more than 25 percent sulfur, imported into the United States, 1939–43, by customs districts, in long tons

Customs district	1939	1940	1941	1942	1943
Buffalo	21, 940	80, 076	227, 510	225, 924	159, 483
Maryland	176, 982	19, 702	24, 231	12, 561	10, 357
Massachusetts				82	69
Michigan			12, 569	29, 163	28, 051
Montana and Idaho				366	
New York	46, 170	82, 292	317		
Ohio	2, 000			1	71
Philadelphia	189, 727	215, 373	88, 219	6, 102	47, 928
St. Lawrence				80	
San Diego		203	320	732	273
South Carolina	4, 396				
Vermont	31, 433	937	3, 889	15, 440	8, 562
Virginia	8, 885	8, 331	11, 781	4, 000	
Washington	803	90	2	5, 689	1, 514
	482, 336	407, 004	368, 838	300, 140	256, 308

WORLD PRODUCTION

Lack of official statistics from most countries leaves much doubt as to what degree of success consumers have had in replacing tonnage formerly supplied by such large producers as Spain and Cyprus. From the meager information available, it seems likely that world production of pyrites did not exceed 9,000,000 metric tons in 1943 and may have been substantially less.

World production of pyrites (including cupreous pyrites), 1938, 1942, and 1943, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938		1942		1943	
	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content
Algeria	44, 150	19, 430	(2)	(2)	(2)	(2)
Australia: Tasmania	51, 084	(2)	(2)	(2)	35, 002	(2)
Canada	40, 464	20, 300	(2)	(2)	(2)	(2)
Cyprus (exports)	523, 574	256, 551	(2)	(2)	(2)	(2)
Czechoslovakia [3]	(2)	(2)	[4] 10, 000	(2)	(2)	(2)
Finland	102, 979	44, 281	(2)	(2)	(2)	(2)
France	147, 208	65, 655	(2)	(2)	(2)	(2)
Germany	465, 267	200, 064	(2)	(2)	(2)	(2)
Greece	244, 000	118, 605	(2)	(2)	(2)	(2)
Italy	930, 312	386, 079	(2)	(2)	(2)	(2)
Norway	1, 027, 776	446, 939	(2)	(2)	(2)	(2)
Poland	92, 209	36, 883	(2)	(2)	(2)	(2)
Portugal	558, 327	251, 250	134, 915	[4] 56, 664	[5] 40, 127	[4] [5] 16, 853
Rumania	11, 205	7, 061	(2)	(2)	(2)	(2)
Southern Rhodesia	27, 065	10, 900	(2)	(2)	(2)	(2)
Spain [6]	2, 727, 003	[4] 1, 145, 341	463, 533	[4] 194, 684	534, 687	[4] 224, 569
Sweden	186, 390	84, 345	(2)	(2)	(2)	(2)
Union of South Africa	31, 017	13, 947	[5] 30, 264	[5] 13, 416	[5] 27, 343	[5] 11, 963
United Kingdom	4, 351	(2)	(2)	(2)	(2)	(2)
United States	564, 547	222, 612	731, 925	311, 885	815, 262	333, 442
Uruguay	70	(2)	(2)	(2)	(2)	(2)
Yugoslavia	150, 402	67, 681	(2)	(2)	(2)	(2)
Estimated world total	10, 000, 000	4, 300, 000	9, 000, 000	3, 900, 000	9, 000, 000	3, 900, 000

[1] In addition to countries listed Belgium, Brazil, China, Chosen, Eire, India, Japan, and U. S. S. R. produced pyrites, but production data are not available.

[2] Data not available. [3] Slovakia only. [4] Estimate. [5] January to September, inclusive.

[6] Average sulfur content of pyrites was 42 percent in 1931, latest year for which such information is available.

Canada.—Canada is poor in sulfur and rich in pyrites so the tendency is to utilize pyrites even in the manufacture of sulfur compounds for the paper industry. Native sulfur has been preferred for this purpose in the past, but an improved plant using pyrites is now supplying a large part of the requirements of the St. Lawrence Paper Co. Also a plant has been installed recently by E. B. Eddy Co., Ltd.

Ten plants operating in Canada produced 578,474 tons of sulfuric acid in 1942.[8]

In 1943 the Aldermac mine closed down, having exhausted its ore body. This mine has been furnishing a large part of the Canadian pyrites exported to the United States, and exports probably will be sharply reduced, as no successor has yet appeared.

Germany.—Reports from Europe indicate that loss of access to some Mediterranean sulfur has inconvenienced but not crippled German industry. Although an acid shortage is believed to exist, most deficiencies have been filled by increased production of pyrites, recovery of byproducts, and regeneration of spent acid. Germany proper has rather large deposits of pyrites mixed with zinc blende in Meggen near Cologne. Smaller deposits of sulfur-bearing ores occur in Austria, Czechoslovakia, and Poland. Increased production is also believed to be coming from plants utilizing gypsum as a raw material. The Wolfen plant of I. G. Farbenindustrie resumed operation in 1937 and has been furnishing 80,000 tons of acid a year, using an improved process developed at Leverkusen. Gypsum is also being used instead of sulfuric acid to provide the sulfur content of ammonium sulfate in the Luena plant of I. G. Farbenindustrie in Saxony.[9]

Great Britain.—Historically, Great Britain has depended on imports of sulfur and pyrites, but shipping stringencies have focused attention on byproduct acid recovery and more recently on the extraction of pyrites from coal-mine waste. The sulfur in Britain's annual coal output is estimated to be about 2½ million long tons. Current British output of sulfuric acid is estimated to be over 2,000,000 long tons.[10]

Some encouragement was given pyrites-extraction plans by the Government Sulfuric Acid Control.[11]

Portugal.—Mason & Barry, Ltd., reported that 83,433 long tons of pyrites were raised from the mine in 1942; 42,995 long tons of pyrites and 14,909 tons of sulfur were shipped.[12]

Spain.—Export difficulties continued to restrict production of pyrites in Spain in 1943. Although sales to the United States were greater than in 1942, they totaled only a fraction of the 300,000 long-ton level common before the war.

Union of South Africa.—Although everyone involved agrees that maximum use of domestic pyrites is commendable, the acid consumers, principally the superphosphate producers, point out that transportation costs from the Rand mines to the Cape are so high that in peacetime importation of sulfur is more economical. An investigation revealed that ample quantities of pyrites are available, but the investigating committee decided that the time and expense required for the installation of new equipment were not warranted in the face of the fact that the superphosphate industry is not protected by tariffs. At present the plant at Unbogintwini, Natal, uses pyrites from West Rand Consolidated Mines, Ltd., and the plant at Somerset West, Cape Province, uses imported sulfur. About 33,000 long tons of pyrites are produced annually.[13]

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[8] Chemical Engineering and Mining Review, vol. 35, No. 415, April 1943, p. 180.
[9] Chemical Age (London), vol. 48, No. 1238, March 1943.
[10] Chemical and Metallurgical Engineering, vol. 51, No. 3, March 1944, p. 153.
[11] Chemical Age (London), vol. 50, No. 1281, January 1944, p. 87.
[12] Mining Magazine (London), vol. 68, No. 6, June 1943, p. 324.
[13] South African Mining and Engineering Journal, vol. 54, No. 2031, July 3, 1943, p. 391.

PHOSPHATE ROCK

By Bertrand L. Johnson and K. G. Warner

SUMMARY OUTLINE

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GENERAL CONDITIONS

A new record for the marketed production of domestic phosphate rock was made in 1943, the quantity sold or used by producers reaching 5,126,232 long tons (see fig. 1), nearly half a million tons greater than the previous record, that for 1941. Florida was the only State showing an increase in sales. The value—nearly 2½ million dollars more than that of 1942—was less than that for 1920. Mined production reached a new high point in 1943—5,369,967 long tons. Exports continued to decline and dropped to 358,010 long tons, but imports rose sharply. Stocks in producers' hands at the end of the year were less than on December 31, 1942. Apparent domestic consumption reached new heights—17 percent above the previous record made in 1942.

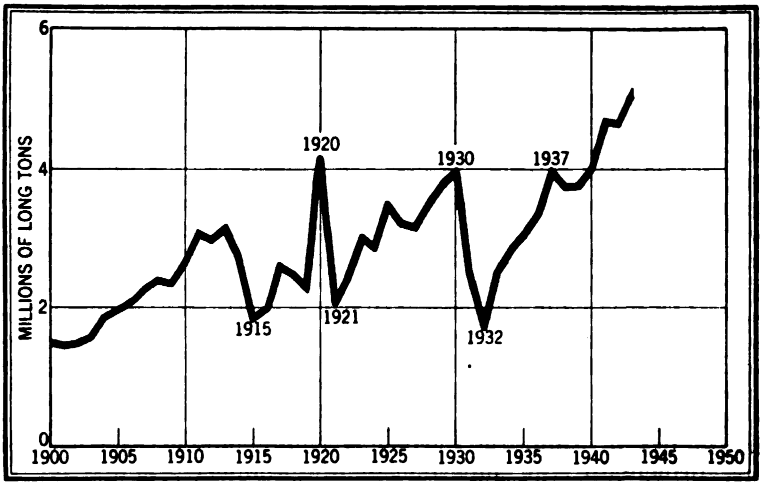

Figure 1.—Marketed production of domestic phosphate rock, 1900-1943.

The rated annual capacity of the phosphate fertilizer-manufacturing industry in the United States in 1943 is given by the Tennessee Valley Authority as 1,712,000 tons of P_2O_5.[1] For 1943, for the first time, the Bureau of Mines collected from the producers figures for the P_2O_5 content of the domestic production and sales of phosphate rock; these are given in the accompanying salient statistics table. The P_2O_5 content of domestic phosphate rock sold or used in 1943 was 1,654,493 long tons.

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[1] Annual Report of the Tennessee Valley Authority for the Fiscal Year Ended June 30, 1943, p. 12.

Salient statistics of the phosphate-rock industry in the United States, 1942–43

	1942			1943			
	Long tons	Value at mines		Long tons		Value at mines	
		Total	Average	Rock	P_2O_5 content	Total	Average
Production (mined)	4,818,938	(1)	(1)	5,369,967	1,611,215	(1)	(1)
Sold or used by producers:							
Florida:							
Land pebble	2,893,756	$8,826,705	$3.05	3,483,194	1,179,314	$11,633,241	$3.34
Soft rock	48,470	155,345	3.20	71,171	14,739	254,995	3.58
Hard rock	70,014	396,527	5.66	34,128	12,208	201,241	5.90
Total Florida	3,012,240	9,378,577	3.11	3,588,493	1,206,261	12,089,477	3.37
Tennessee [2] [3]	1,366,335	6,127,792	4.48	1,309,059	375,502	5,822,249	4.45
Idaho	114,079	511,249	4.48	108,916	34,709	561,630	5.16
Montana	150,402	572,464	3.81	119,764	38,021	488,665	4.08
Utah	1,184	7,410	6.26				
Virginia	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total United States	4,644,240	16,597,492	3.57	5,126,232	1,654,493	18,962,021	3.70
Imports [4]	3,765	24,887	6.61	46,505	(1)	377,158	8.11
Exports [5]	528,716	3,348,341	6.33	358,010	(1)	2,871,136	8.02
Apparent consumption [6]	4,119,289			4,814,727	(1)		
Stocks in producers' hands, Dec. 31:							
Florida	1,426,000	(1)	(1)	1,110,000	371,000	(1)	(1)
Tennessee [2] [3] [7]	437,000	(1)	(1)	640,000	136,000	(1)	(1)
Western States	4,000	(1)	(1)	2,000	1,000	(1)	(1)
Total stocks	1,867,000	(1)	(1)	1,752,000	508,000	(1)	(1)

[1] Figures not available.
[2] Includes sintered matrix.
[3] Virginia included with Tennessee.
[4] Market value (or price) at port and time of exportation to the United States.
[5] Value at port of exportation.
[6] Quantity sold or used by producers plus imports minus exports.
[7] Includes brown-rock matrix of sinter grade, sintered brown rock, and blue rock.

General papers published recently include those by McConnell,[2] Mitchell, Faust, Hendricks, and Reynolds,[3] Chapman,[4] and Jenkins.[5]

PRODUCTION

A new high record for phosphate rock mined in the United States was made in 1943, exceeding the previous high made in 1941 by 447,784 tons. Phosphate rock was mined in 1943 in Florida, Tennessee, Montana, and Idaho and apatite in Virginia.

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[2] McConnell, Duncan, Isomorphism and Isotypism Among Silicates and Phosphates: Science, vol. 97, 1943, pp. 98–99. Phosphatization at Malpelo Island, Colombia: Bull. Geol. Soc. America, vol. 54, 1943, pp. 707–716.

[3] Mitchell, Lane, Faust, G. T., Hendricks, S. B., and Reynolds, D. S., The Mineralogy and Genesis of Hydroxylapatite: Am. Mineral., vol. 28, 1943, pp. 356–371.

[4] Chapman, C. A., Large Magnesia-Rich Triphylite Crystals in Pegmatite: Am. Mineral., vol. 28, 1943, pp. 90–98.

[5] Jenkins, R. L., Where There's Smoke, There's Reduced Fire: Monsanto Mag., vol. 22, No. 5, October-November 1943, pp. 4–7.

Phosphate rock mined in the United States, 1934–43, by States, in long tons

Year	Florida	Tennessee [1]	Western States	United States	Year	Florida	Tennessee [1]	Western States	United States
1934	2,464,969	394,311	38,958	2,898,238	1939	2,791,360	1,057,570	139,040	3,987,970
1935	2,598,337	493,501	67,490	3,159,328	1940	2,782,956	1,120,551	164,570	4,068,077
1936	2,645,819	737,866	79,152	3,462,837	1941	3,417,900	1,301,067	203,216	4,922,183
1937	3,179,588	942,158	139,670	4,261,416	1942	2,984,503	1,568,162	266,273	4,818,938
1938	2,722,927	[2] 999,551	137,998	3,860,476	1943	3,274,266	1,868,407	227,294	5,369,967

[1] Includes small quantity of apatite from Virginia.
[2] Includes small quantity of phosphate rock from South Carolina.

SALES

The quantity of domestic phosphate rock sold or used by producers made a new high record in 1943 and exceeded the previous maximum of 1941 by nearly one-half million tons. The total value was nearly 2½ million dollars more than that of 1942 but was still about 6 million dollars below the record value of the boom year 1920. The average value per ton increased.

Phosphate rock sold or used by producers in the United States, 1939–43

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1939	3,757,067	$12,294,042	$3.27	1942	4,644,240	$16,597,492	$3.57
1940	4,002,700	12,334,662	3.08	1943	5,126,232	18,962,021	3.70
1941	4,689,652	15,596,273	3.33				

DISTRIBUTION OF SALES

Nearly a third of the phosphate rock sold or used by producers in the United States in 1943 was of the 72-percent B. P. L. grade; all grades above this equaled about another third. Phosphate rock containing less than 60 percent B. P. L. continued to form an increasing part of the total sold or used and reached 11 percent of the total in 1943, or more than one-half million tons.

In 1943, 71 percent of the domestic phosphate rock sold or used by producers is reported to have gone into the manufacture of superphosphates. The quantity so used was more than a third of a million tons greater than in 1942. A sharp increase is reported in the quantity sold or used for the production of various chemicals; the quantity sold or used for direct application to the soil continued its upward trend, and that utilized for making stock and poultry feed jumped to 67,288 tons in 1943. A primary reason for this latter increase was a deficit in the supply of the usual phosphorus supplements for animal feed, principally bone meal, owing to the increased needs of the greater livestock production and the curtailment of imports of bone products. Detailed discussions of phosphate rock and phosphorus in animal feeds have recently appeared.[6] A list of the companies reporting phosphate rock sold or used in 1943 for the production of stock and poultry feed follows:

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[6] Jacob, K. D., Phosphorus Supplements for Livestock: Feedstuffs, February 12, 1944, 4 pp.
Frazer, H. F., Hoppe, T. C., Sullivan, J. H., and Smith, E. R., Phosphate Fertilizers as Possible Source of Phosphorus for Animals: Ind. and Eng. Chem., ind. ed., vol. 35, 1943, pp 1087–1090.

Companies reporting the use or sale of phosphate rock for animal feed in 1943

Florida:
- Land pebble:
  - American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.
  - Southern Phosphate Co., 342 Madison Ave., New York 17, N. Y.
- Soft rock:
  - Colloidal Phosphate Sales Co., P. O. Box 1588, Tampa.
  - The Kellogg Co., Hernando.
  - Loncala Phosphate Co., Box 338, High Springs.
  - Sea Board Phosphate Co., S. W. Corner Meadow and McKean Sts., Philadelphia 48, Pa.
  - Soil Builders, Inc., Dunnellon.
  - Superior Phosphate Co., Box 476, Dunnellon.

Tennessee:
- Hoover & Mason Phosphate Co., 8 South Michigan Ave., Chicago, Ill.
- Tennessee Valley Authority, Dept. of Chem. Eng., Wilson Dam, Ala.

Western States:
- Anaconda Copper Mining Co., Fertilizer Dept., Conda, Idaho.
- Teton Phosphate Co., Inc., 1417 Denver Ave., Boise, Idaho.

Phosphate rock sold or used by producers in the United States, 1942–43, by grades and uses

	1942			1943		
	Quantity		Value	Quantity		Value
	Long tons	Percent of total		Long tons	Percent of total	
Grades—B. P. L.[1] content (percent):						
Below 60	477,916	10	(2)	566,704	11	(2)
60 to 66	1,412	(3)	(2)	186,726	4	(2)
68 basis, 66 minimum	373,329	8	(2)	264,043	5	(2)
70 minimum	198,820	4	(2)	490,208	9	(2)
72 minimum	1,686,312	37	(2)	1,611,500	31	(2)
75 basis, 74 minimum	736,797	16	(2)	698,476	14	(2)
75 minimum						
77 basis, 76 minimum	559,111	12	(2)	851,055	17	(2)
77 minimum						
Above 85 (apatite)	610,543	13	(2)	457,520	9	(2)
Undistributed [4]						
	4,644,240	100	$16,597,492	5,126,232	100	$18,962,021
Uses:						
Domestic:						
Superphosphates	3,242,689	70	(2)	3,631,786	71	(2)
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	649,816	14	(2)	846,305	17	(2)
Direct application to soil	184,233	4	(2)	193,931	4	(2)
Fertilizer filler	30,116	1	(2)	27,690	(3)	(2)
Stock and poultry feed	8,466	(3)	(2)	67,288	1	(2)
Undistributed [5]	6,146	(3)	(2)	8,347	(3)	(2)
Exports [6]	522,774	11	2,354,019	350,885	7	1,607,909
	4,644,240	100	16,597,492	5,126,232	100	18,962,021

[1] Bone phosphate of lime.
[2] Figures not available.
[3] 0.5 percent or less.
[4] Includes grades of B. P. L. content 65.9, 68.2, 68.6, 68/69, 69, 69.2–69.4, 71, 73, 73.2, 73.3, 73.6, 73/74, 77 plus, 78, and above 85 percent; B. P. L. content not known for ground phosphate rock and dust in 1942.
[5] Includes some calcined phosphate and phosphatic material used in pig-iron blast furnaces, construction work, filter bed, parting compounds, research, refractories, in manufacture of concentrated fertilizers, and in minor uses not specified.
[6] As reported to Bureau of Mines by domestic producers.

CONSUMPTION

The annual apparent consumption of phosphate rock in the United States continued its abnormal rise under war conditions in 1943 and reached a new high record nearly 700,000 tons above the previous high in 1942. The annual consumption of phosphate rock in the United States from 1867 to 1943 is shown in figure 2. The effect of World War II upon domestic consumption is shown in the abnormal extension of the line showing consumption above the logistic curve indicative of the normal growth of consumption. The ever-increasing width of the fluctuations across this growth line since 1910 is worth serious consideration in any study of the future outlook for domestic demands.

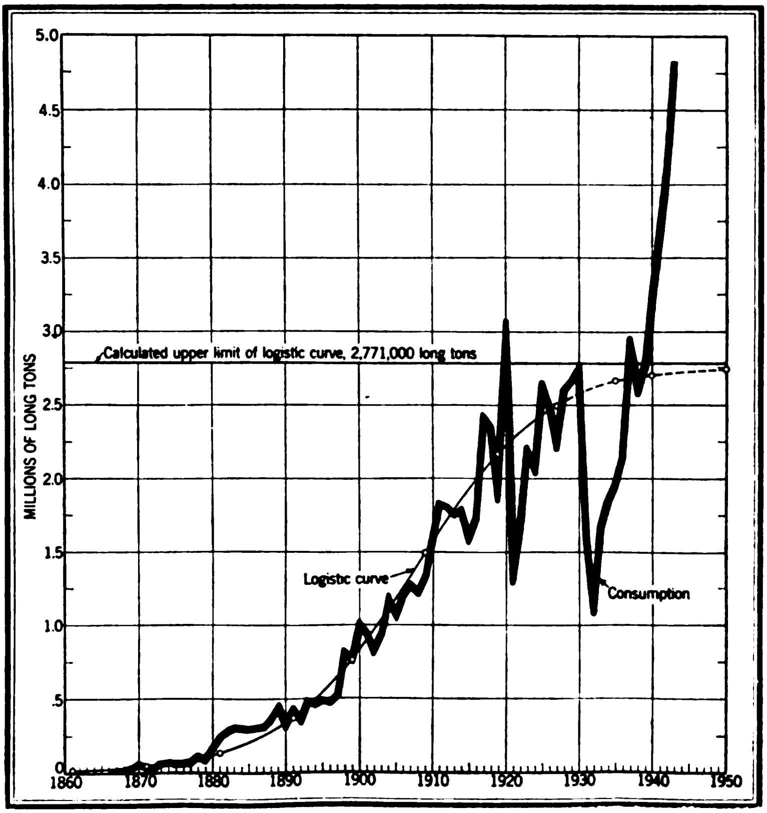

FIGURE 2.—Consumption of phosphate rock in the United States, 1867–1943.

PRICES

The ceiling prices per long ton of various grades of Florida and Tennessee unground phosphate rock are shown in the accompanying table. Maximum prices for Florida land-pebble phosphate rock and Tennessee brown-rock phosphate were established by the Office of Price Administration in a schedule issued October 13, 1942, effective October 19, 1942 (Maximum Price Regulation 240). An amendment to this regulation (M. P. R. 240, amendment 3) issued November 27, 1943, effective December 3, 1943, increased Tennessee producers' prices 20 cents a ton to compensate mine operators for wage increases granted to their employees. Pricing problems in the fertilizer industry were discussed by Gran of O. P. A.[7]

Ceiling prices per long ton of Florida and Tennessee unground phosphate rock, f. o. b. cars at mines, in 1943, by grades [1]

Florida land pebble		Tennessee brown rock		
Grades—B. P. L.[2] content (percent)	Prices	Grades—B. P. L.[2] content (percent)	Prices	
			Jan. 1–Dec. 2	Dec. 3–31
68/66	$2.00	68/66	$4.30	$4.50
70/68	2.40	70/68	4.80	5.00
72/70	3.00	72/70	5.30	5.50
75/74	4.00			
77/76	5.00			

[1] Office of Price Administration, M. P. R. 240, Oct. 13, 1942; M. P. R. 240, Amendment 3, November 27, 1943.
[2] Bone phosphate of lime.

During the fiscal year ended June 30, 1943, the Federal Trade Commission[8] made an inquiry into costs, prices, and profits in the fertilizer and related products industries. This inquiry was made at the request of the Office of Price Administration so that it might have the factual background for its price actions.

Information as to costs, prices, and profits was obtained with reference to the operations of 12 phosphate rock mines of 11 companies, and for the sulfuric acid, superphosphate and mixed fertilizer operations of 40 plants of 24 companies. From time to time, during the course of the inquiry, reports were prepared and forwarded to the Office of Price Administration with reference to these operations for the companies included in the inquiry.

The various reports on the results of the study contain financial data for individual companies for each of the years 1936–42, including rates of profit on investment and percentage of profit on sales. For the years 1941 and 1942, they include the details of the cost of production, the cost and profit per ton of product with reference to phosphate rock, sulfuric acid, superphosphate and mixed fertilizer, and the net realization from the sales of selected grades of fertilizer, analysis of purchases of fertilizer materials, and other related statistics.

REVIEW BY STATES

Florida.—New records were set in 1943 for the quantities of land pebble, soft rock, and total Florida phosphate rock sold or used (see fig. 3), whereas the quantity of hard rock marketed was less than half that in 1942. The total quantity of phosphate rock sold or used by producers in Florida was 219,109 tons more than the previous record, in 1920. The total value of the rock sold or used in 1943 was, however, over 7 million dollars less than in 1920. Soft-rock sales were much above the previous record high of 1937. The average values per ton for all types were higher in 1943 than in 1942. The P_2O_5 content (tonnage) of the various types of Florida rock sold or used is given in the salient statistics table—first table of this chapter.

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[7] Gran, C. G., Fertilizer Pricing Problems: Nat. Fertilizer Assoc., Proc. 19th Ann. Convention, 1943, pp. 39–51.
[8] Federal Trade Commission, Annual Report for the Fiscal Year Ended June 30, 1943: 1943, 128 pp. (see pp. 23–24).

In 1943 hard-rock phosphate was mined only at the joint operations of C. & J. Camp, Inc., and J. Buttgenbach & Co. in sec. 22, Citrus County, about 3 miles from Hernando. The only other hard-rock-phosphate mining company—the Dunnellon Phosphate Mining Co., of Savannah, Ga.—did no mining in 1943 but shipped hard rock from stocks. Virtually all of the shipments of hard rock during the year were for export.

The mine and washer of the Pembroke Chemical Corporation, Pembroke, in the land-pebble field were shut down during the year; but the drying plant operated, and shipments of dried rock were made. The other seven companies usually operating in the land-pebble field—American Cyanamid Co., Brewster; American Agricultural Chemical Co., Pierce; Coronet Phosphate Co., Plant City; International Minerals & Chemical Corporation, Mulberry; Phosphate Mining Co., Nichols; Southern Phosphate Corporation, Ridgewood; and the Swift & Co. Fertilizer Works, Agricola—continued to mine and ship land pebble.

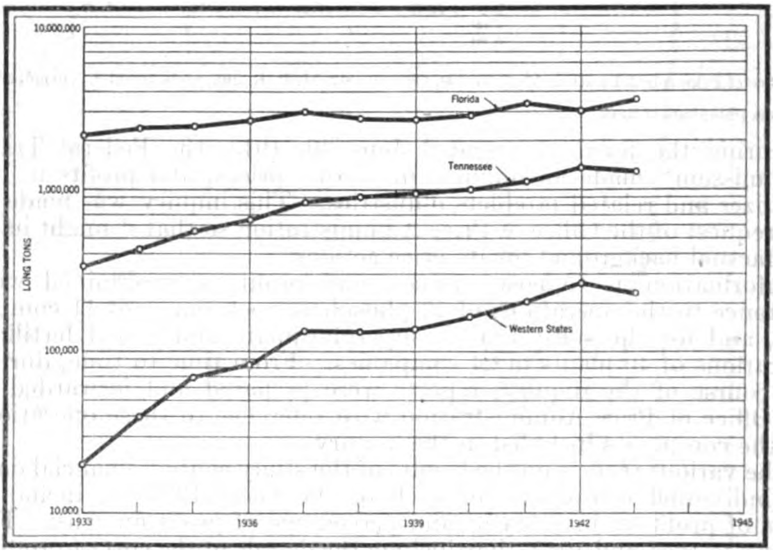

FIGURE 3.—Rate of growth of phosphate rock sold or used by producers, by States, 1933–43.

Stocks of Florida phosphate rock on December 31, 1943, as reported by producers, were down sharply from the previous year.

Taylor,[9] in the fifth article of a series, continued his description of current practices in the land-pebble phosphate-rock field.

The idle blast-furnace and sintering plant of the Pembroke Chemical Corporation, Pembroke, Fla.,[10] are to be dismantled and shipped to Rusk, Tex., for use in the production of charcoal iron from the brown iron ores of eastern Texas. This electrically operated blast furnace was originally built at Pembroke to produce elemental phosphorus from phosphate rock and coke.

Statistical data on re-treatment, between November 6, 1941, and April 19, 1942, of washer-waste accumulations at Mine No. 9 of the

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[9] Taylor, W. H., Land-Pebble Phosphate Deposits of Florida—V: Pit and Quarry, vol. 36, No. 1, July 1943, pp. 43–45, 47.

[10] Sweetser, R. H., Charcoal Pig-Iron Project at Rusk, Tex.: Min. and Met., vol. 25, March 1944, p. 155.

International Minerals & Chemical Corporation have been published.[11]

Vernon[12] has called attention to the relationship between the Florida phosphate deposits and the Pleistocene terraces, different phosphate beds underlying separate terraces; some terraces in the land-pebble field have surface elevations 78, 94, 110, 121, and 212 feet above sea level.

The Dixie Phosphate Co., one of the several companies producing "colloidal" phosphate, leased its plant at Dunnellon, Fla., on October 22, 1943, to the Sea Board Phosphate Co., S. W. Corner Meadow and McKean Sts., Philadelphia 48, Pa., who operated it during the rest of the year.

Volk[13] has presented the results of a comparative study of the fertilizing value of waste-pond phosphates, phosphate rock, and superphosphate.

Florida phosphate rock sold or used by producers, 1939–43, by kinds

Year	Hard rock			Soft rock[1]		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1939	89,096	$411,455	$4.62	41,906	$128,435	$3.06
1940	22,367	100,353	4.49	41,845	102,508	2.45
1941	38,116	211,049	5.54	47,750	132,472	2.77
1942	70,014	396,527	5.66	48,470	155,345	3.20
1943	34,128	201,241	5.90	71,171	254,995	3.58

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1939	[2] 2,547,782	[2] $7,353,567	$2.89	[2] 2,678,784	[2] $7,893,457	$2.95
1940	[2] 2,780,800	[2] 7,538.316	2.71	[2] 2,845,012	[2] 7,741,177	2.72
1941	3,279,706	9,890,510	3.02	3,365,572	10,234.031	3.04
1942	2,893,756	8,826,705	3.05	3,012,240	9,378,577	3.11
1943	3,483,194	11,633,241	3.34	3,588,493	12,089,477	3.37

[1] Includes material from waste-pond operations.
[2] Includes sintered matrix.

Tennessee.—According to reports from the producing companies, the tonnage of phosphate rock sold or used by Tennessee producers in 1943 (plus a small quantity of apatite from Virginia) declined for the first time in many years. This slight reversal of a long established upward trend is indicated in figure 3. The phosphate rock sold or used—all brown rock, except for a little blue rock used by the Tennessee Valley Authority, withdrawn from its stocks, and the Virginia apatite—was nearly 60,000 tons less than in 1942. The total value was also less than in 1942 but still greater than in years immediately preceding. Stocks in the hands of the producers on December 31, 1943, showed a considerable increase over the quantity on hand at the close of 1942. The P_2O_5 contents (tonnages) of the phosphate rock mined, of that sold or used and of the stocks are given in the salient statistics table—first table of this chapter.

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[11] Engineering and Mining Journal, New Data on Mining and Pumping Phosphatic Debris in Florida: Vol. 144, No. 3, March 1943, p. 62.

[12] Vernon, R. O., Florida Mineral Industry with Summaries of Production for 1940 and 1941: Florida Geol. Survey Bull. 24, 1943, 207 pp.

[13] Volk, G. W., Waste-Pond Phosphate Compared with Rock Phosphate and Superphosphate as a Fertilizer: Jour. Am. Soc. Agronomy, vol. 34, 1942.

Tennessee phosphate rock (including sintered matrix) sold or used by producers, 1939–43

[Includes apatite from Virginia]

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1939 [1]	938,448	$3,856,505	$4.11	1942 [2]	1,366,335	$6,127,792	$4.48
1940	994,361	3,967,043	3.99	1943 [2]	1,309,059	5,822,249	4.45
1941	1,120,358	4,590,965	4.10				

[1] Separate figures for brown rock and blue rock cannot be given without disclosing confidential data regarding blue-rock production.
[2] Includes a small quantity of blue rock.

Tennessee brown-rock phosphate was mined in 1943 by the Tennessee Valley Authority and the following private companies: Armour Fertilizer Works, Federal Chemical Co., Gilbreath & Pressnell, Harsh Phosphate Co., Hoover & Mason Phosphate Co., International Minerals & Chemical Corporation, Monsanto Chemical Co., and the Virginia-Carolina Chemical Corporation.

The International Minerals & Chemical Corporation, in its annual report for the fiscal year ended June 30, 1943, states that additional reserves of phosphate rock were acquired by purchase during the year and that the shipments from its Tennessee mines in the year covered by the report were the largest in the corporation's history.

Operations of the Monsanto Chemical Co. were described in an article by Robbins.[14]

According to the annual report of the Tennessee Valley Authority for the fiscal year ended June 30, 1943, a total of 253,840 tons of phosphatic materials, all from deposits in Tennessee, was received at Muscle Shoals during the fiscal year. Large-scale operation of the Authority's field phosphate plants in middle Tennessee got under way, although necessary changes and substitutions in experimental units reduced deliveries below the quantity anticipated. Shipments from the field plants totaled 117,000 dry net tons, of which 89,000 tons were used in phosphate operations. The latter amount corresponds to about one-third of the quantity consumed during the period. By the close of the fiscal year the field plants were supplying approximately two-thirds of the total tonnage of phosphate needed for operation of the Muscle Shoals plant; the remainder was being purchased.

During the year the Tennessee Valley Authority acquired additional phosphate reserves in Tennessee, including mineral rights on deposits containing an estimated 5,167,000 tons of minable phosphate and an estimated 893,000 tons of minable phosphate on land acquired in fee simple. The net increase in the Authority's phosphate reserves—new reserves acquired minus 214,000 tons mined—was 5,846,000 tons—an increase in the total reserve of 22,100,000 to 28,000,000 tons of minable phosphate.

Military demands for elemental phosphorus took approximately two-thirds of the entire Authority production of 18,900 tons during the fiscal year 1943, and somewhat more than one-fifth of the military supply was provided for lend-lease shipment. During the year, the Authority completed conversion of all of its phosphorus electric furnaces but one to production of munition-grade elemental phosphorus. One furnace produces phosphoric acid directly.

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[14] Robbins, W. C., Phosphorus from the Red Clay of Tennessee: Excavating Eng., vol. 37, No. 8, August 1943, pp. 384-387, 409.

Although somewhat more than 6,000 tons of phosphorus not immediately demanded by the War Department were used in manufacture of concentrated superphosphate and calcium metaphosphate, the over-all production of these plant foods represented a sharp reduction for the second year in succession. At the same time much less was available for domestic agricultural use because 54,000 of the 77,300 tons of concentrated superphosphate shipped from Muscle Shoals was provided for lend-lease. Actual production was about 60,200 tons of concentrated superphosphate and 7,300 tons of calcium metaphosphate.

Approximately 4,700 additional farms joined the Authority's test-demonstration program during the fiscal year 1943. This brought the number that has participated from the beginning to about 44,000, of which about 30,000, scattered through 862 counties in 29 States, were active participants on June 30, 1943.

At the close of the fiscal year 1943 the Authority was preparing to produce 15,000 tons of dicalcium phosphate during the fiscal year 1944, for direct feeding to stock as a substitute for bone meal in the present scarcity of that source of phosphorus for mineral supplements of animal feed.

Virginia.—The Southern Mineral Products Corporation, a subsidiary of the Vanadium Corporation of America, operated its Piney River nelsonite deposit during most of 1943, disposing of the apatite and ilmenite concentrates recovered at its mill to the adjacent plant of the Virginia Chemical Corporation. The ilmenite was used in the manufacture of titanium dioxide and the apatite in the production (during the early months of 1943) of monocalcium phosphate. Manufacture of this latter chemical was discontinued in July 1943, and the apatite later was used for making defluorinated phosphate. The Virginia Chemical Corporation, a wholly owned subsidiary of Interchemical Corporation, purchased the physical assets of the Southern Mineral Products Corporation on December 22, 1943. Early in 1944 the company was manufacturing titanium dioxide, sulfuric acid, ferrous sulfate, defluorinated phosphate, and hydrated yellow ferric oxide.

Western States.—The marketed production of Western States phosphate rock experienced a set-back in 1943 of 14 percent from the record total reached in 1942 (see fig. 3). The total value was slightly more than a million dollars. The output in 1943 came from Idaho and Montana; Utah was inactive. The average P_2O_5 content of Western States phosphate rock sold or used in 1943 is reported as 31.80 percent.

Idaho rock sold or used in 1943 was about 5 percent less than the record production for 1942. The same two companies were active in this State as in 1942. By far the larger of these, the Anaconda Copper Mining Co., operated its No. 3 mine at Conda, Caribou County. Most of the Conda shipments in 1943 went to Anaconda, Mont., for conversion to superphosphate. Much smaller quantities were used for the production of phosphate chemicals, for direct application to the soil, for animal feed, and for fertilizer filler. Some was exported. The other producer (the Teton Phosphate Co., Boise) shipped phosphate rock from its holdings in Bear Lake County near Montpelier. Most of this material was sold for direct application to the soil. A small quantity was shipped for use in animal feeds.

The geologic features of eastern Idaho and western Wyoming are described in a paper by Nelson and Church.[15]

Montana was the largest phosphate-rock producer of the Western States group in 1943 as in 1942 (see fig. 4), although its lead in sales was not nearly as great as in 1942. Its sales in 1943 were 20 percent less than the record made in 1942. Montana had but one producing company in 1943—the Montana Phosphate Products Co. of Trail, British Columbia. This company operated the Anderson mine near Garrison, as well as several Federal leases in Powell County. It leased the property of the Mineral Hill Mining Co. near Avon, Powell County, on July 7, 1943, and operated it after that date. Most of the product of these various operations was exported to the Consolidated Mining & Smelting Co. of Canada at Trail. A considerable amount, however, was sold in the United States. The Mineral Hill Mining Co. did not operate its property in 1943 before leasing it. L. H. Skeels, who shipped a small quantity of phosphate rock from a property near Maxville, Granite County, in 1942, did not operate in 1943. The International Minerals & Chemical Corporation, which in 1942 acquired the Federal lease of the Northwestern Improvement Co., St. Paul, Minn. (Great Falls Serial No. 077838) conducted some exploratory work on the property in 1943 but did no mining on a commercial basis.

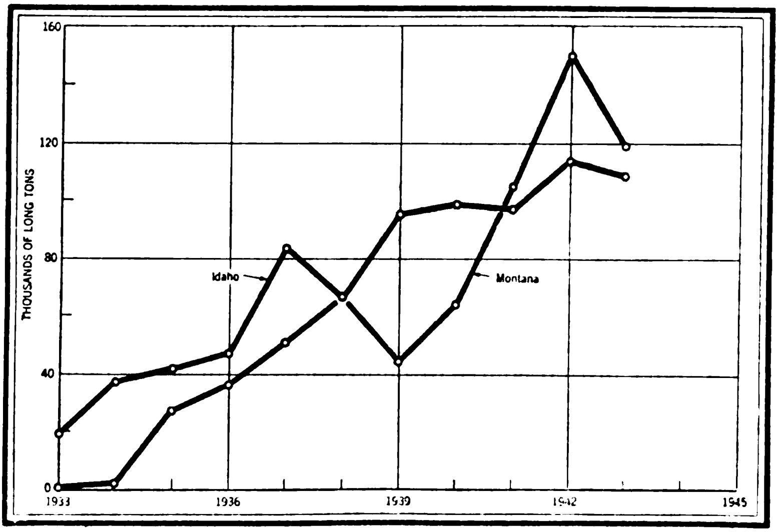

FIGURE 4.—Idaho and Montana phosphate rock sold or used by producers, 1933–43.

No phosphate-rock production was reported from Utah in 1943.

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[15] Nelson, V. E., and Church, Victor., Critical Structure of the Gros Ventre and Northern Hoback Ranges, Wyoming: Jour. Geol., vol. 41, No. 3, April-May 1943, pp. 143–166.

The Garfield Chemical & Manufacturing Corporation, Salt Lake City, Utah, which mined and shipped in 1942 from Federal-leased land near Spanish Fork, Utah County, for use in pig-iron blast furnaces, did not report any operations on this leased ground in 1943.

The average value per ton of the Western States phosphate rock sold or used, as reported by producers to the Bureau of Mines, increased sharply from $4.11 in 1942 to $4.59 in 1943. The increase per ton was 68 cents in Idaho and 27 cents in Montana.

Western States phosphate rock sold or used by producers, 1939–43

Year	Idaho			Montana			Utah			Total		
	Long tons	Value at mines		Long tons	Value at mines		Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average		Total	Average		Total	Average
1939	95,451	$431,938	$4.53	44,384	$112,142	$2.53	----------	----------	----------	139,835	$544,080	$3.89
1940	99,088	441,598	4.46	64,239	184,844	2.88	----------	----------	----------	163,327	626,442	3.84
1941	97,274	444,154	4.57	105,108	318,588	3.03	1,340	$8,535	$6.37	203,722	771,277	3.79
1942	114,079	511,249	4.48	150,402	572,464	3.81	1,184	7,410	6.26	265,665	1,091,123	4.11
1943	108,916	561,630	5.16	119,764	488,665	4.08	----------	----------	----------	228,680	1,050,295	4.59

FOREIGN TRADE [16]

Imports.—Considerable quantities of both apatite and phosphate rock were imported in 1943. Apatite imports totaled 6,114 long tons compared with 179 tons in 1942. All came from Soviet Russia. Phosphate-rock imports in 1943 were over 10 times those in 1942, owing largely to the importation of phosphate rock from French North Africa early in the year following the capture of this area by the Allied Nations late in 1942. French Morocco furnished 33,779 tons and Algeria 1,000 tons. In addition to the above, 4,112 tons were imported from Curaçao and 1,500 tons are reported to have come from the Union of South Africa.

In June 1943, an agreement is reported to have been put into effect by the Lend-Lease Administration, the Combined Food Board, and the Combined Raw Materials Board whereby supplies of North African phosphate rock would be shipped only to Spain, Portugal, Switzerland, and England.

Exports.—The quantity of phosphate rock exported from the United States in 1943 was even less than in 1942 and apparently reflects the recent availability of North African phosphate rock for

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[16] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Phosphate-rock and phosphatic fertilizers imported for consumption in the United States, 1939–43

Fertilizer	1939		1940		1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Apatite	------	----------	------	----------	------	----------	179	$1,025	6,114	$61,890
Phosphates, crude, not elsewhere specified	3,500	$23,625	2,953	$19,536	4,340	$32,816	3,586	23,862	40,391	315,268
Ammonium phosphates, used as fertilizer	34,995	1,627,608	44,782	1,959,900	55,430	2,483,756	25,521	1,150,319	39,274	1,827,294
Bone dust, or animal carbon, and bone ash, fit only for fertilizing	40,530	799,179	27,676	618,538	27,607	622,731	7,855	213,970	573	24,244
Guano	5,151	211,941	785	17,164	15,394	460,370	3,128	159,799	8,591	526,173
Slag, basic, ground or unground	405	5,168	452	4,766	------	----------	1	10	3	56
Precipitated bone, fertilizer grade	2,314	68,611	1,141	38,225	------	----------	23	851	75	2,730

the European market controlled by the Allied Nations. Exports of land pebble went principally to Canada, but considerable quantities went also to Australia, Eire, New Zealand, and the United Kingdom. Exports of high-grade hard rock went entirely to Canada and the United Kingdom.

Phosphate rock [1] exported from the United States, 1939–43

Year	Long tons	Value		Year	Long tons	Value	
		Total	Average			Total	Average
1939	949,006	$5,233,104	$5.51	1942	528,716	$3,348,341	$6.33
1940	751,495	3,845,495	5.12	1943	358,010	2,871,136	8.02
1941	1,019,960	5,738,859	5.63				

[1] 1939–40: Excludes sintered matrix, which is included under "Other phosphate materials." 1941–43: Excludes "Phosphate rock: Florida: Other (including soft rock, colloidal and sintered matrix)," which is included under "Other phosphate materials."

Phosphate rock [1] exported from the United States, 1939–43, by countries

HIGH-GRADE HARD ROCK

Country	1939		1940		1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Brazil	------	----------	------	----------	201	$3,500	------	----------	------	----------
British Malaya	1,200	$12,000	------	----------	------	----------	------	----------	------	----------
Canada	45,162	276,372	64,542	$394,576	110,658	667,324	157,318	$969,111	102,759	$596,457
Cuba	------	----------	22	210	------	----------	------	----------	------	----------
Germany [2]	55,246	345,290	------	----------	------	----------	------	----------	------	----------
Italy	2,000	12,500	------	----------	------	----------	------	----------	------	----------
Netherlands	14,750	92,188	------	----------	------	----------	------	----------	------	----------
Panama	------	----------	673	3,365	------	----------	------	----------	------	----------
Portugal	------	----------	8,990	60,673	------	----------	------	----------	------	----------
Sweden	14,625	102,375	10,365	72,625	------	----------	------	----------	------	----------
United Kingdom [3]	------	----------	------	----------	45,754	285,062	80,273	497,080	42,815	272,547
	132,983	840,725	84,592	531,449	156,613	955,886	237,591	1,466,191	145,574	869,004

See footnotes at end of table.

Phosphate rock[1] *exported from the United States, 1939–43, by countries*—Continued

LAND PEBBLE

Country	1939		1940		1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Australia									24,457	$128,62
Belgian Congo			3,500	$28,000						
Belgium	36,729	$221,107								
Canada	68,386	319,829	87,112	440,346	103,827	$800,951	97,951	$909,986	129,913	1,522,18
Czechoslovakia[2]	2,498	16,612								
Eire			6,200	34,100			6,697	46,879	18,204	137,33
Germany[2]	271,801	1,623,330								
Hungary[2]	2,500	15,750	5,261	27,884						
Italy	86,375	562,533	33,315	210,286						
Japan	229,404	888,598	218,456	813,095	72,722	274,981				
Liberia					28	288				
Netherlands	27,517	178,283								
New Zealand									13,248	72,864
Nigeria			1,500	12,000						
Norway			2,001	15,007						
Poland and Danzig[2]	2,800	18,814								
Portugal			24,837	136,593	32,490	187,866				
Sweden	71,479	455,332	11,536	74,290						
Union of South Africa			51,311	282,211	55,345	314,658	3,299	18,969		
United Kingdom[3]	13,531	71,921	218,872	1,220,721	598,935	3,204,229	183,178	906,316	26,614	141,122
Yugoslavia	3,003	20,270	3,002	19,513						
	816,023	4,392,379	666,903	3,314,046	863,347	4,782,973	291,125	1,882,150	212,436	2,002,132

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[1] 1939–40: Excludes sintered matrix, which is included under "Other phosphate materials." 1941–43: Excludes "Phosphate rock: Florida: Other (including soft rock, colloidal and sintered matrix)," which is included under "Other phosphate materials."

[2] For statistical purposes, trade with the Sudeten area, as far as ascertainable, is included with Germany, while trade with the other Czechoslovak Provinces occupied by Germany, Hungary, and Poland has been included with these countries since March 18 or 19, 1939. After November 16, 1939, trade with Danzig and that part of Poland occupied by Germany has been included with Germany, and trade with that part of Poland occupied by U. S. S. R. has been included with U. S. S. R.

[3] United Kingdom of Great Britain and Northern Ireland.

High-grade hard-rock phosphate[1] *exported from the United States, 1942–43, by customs districts*

Customs district	1942		1943	
	Long tons	Value	Long tons	Value
Dakota	81	$1,024	32	$1,287
Florida	80,273	497,080	42,815	272,547
Michigan	815	9,053	739	5,947
Montana and Idaho	152,224	913,267	98,292	570,601
St. Lawrence	183	2,441		
Washington	4,015	43,326	3,696	18,622
	237,591	1,466,191	145,574	869,004

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[1] Includes Florida high-grade hard rock and Tennessee, Idaho, and Montana phosphate rock.

Other phosphate materials[1] *exported from the United States, 1939–43*

Year	Long tons	Value	Year	Long tons	Value
1939	29,080	$192,306	1942	5,257	$292,934
1940	11,924	201,047	1943	862	94,391
1941	22,988	262,045			

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[1] Includes bone ash, dust, and meal; animal carbon for fertilizer; basic slag; sintered matrix, etc.

WORLD PRODUCTION

Figures for the production of phosphate rock in most foreign countries in 1943 are not yet available, nor (with the exception of French North Africa) [17] is much information obtainable regarding the foreign phosphate-rock industries. Several of the Japanese-held phosphate islands in the Pacific, including Nauru and Angaur Islands and the apatite workings near Laokay in French Indochina, were bombed by the Allies in 1943 and early in 1944.

World production of phosphate rock, 1939–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943
Algeria	[2] 450,000	(3)	(3)	(3)	(3)
Australia:					
South Australia	(3)	(3)	8,597	(3)	(3)
Western Australia	....	40	(3)	(3)	(3)
Canada	142	325	2,256	1,147	1,302
Chile (apatite)	9,014	32,000	21,380	24,909	(3)
China	[2] 8,000	(3)	(3)	(3)	(3)
Christmas Island, Straits Settlements (exports)	177,972	241,826	(3)	(3)	(3)
Egypt	547,538	183,182	111,708	328,440	315,566
India, British	185	(3)	(3)	(3)	(3)
Indochina	35,694	22,266	(3)	(3)	(3)
Madagascar	[4] 6,600	495	(3)	(3)	(3)
Makatea Island (exports)	160,680	173,177	(3)	(3)	(3)
Morocco, French (shipments)	[5] 1,491,754	(3)	(3)	(3)	(3)
Nauru and Ocean Islands [6]	1,244,170	1,263,385	(3)	(3)	(3)
Netherlands Indies	18,777	34,085	(3)	(3)	(3)
Netherlands West Indies:					
Curaçao (exports)	64,072	6,047	111,995	(3)	(3)
Seychelles Islands (exports)	23,545	14,613	(3)	(3)	(3)
South-West Africa	....	869	(3)	(3)	(3)
Spain	10,320	15,781	13,846	(3)	(3)
Sweden (apatite)	6,267	(3)	(3)	(3)	(3)
Tanganyika Territory	132	9	(3)	(3)	(3)
Tunisia	1,608,045	(3)	[2] 720,000	(3)	(3)
U. S. S. R. (apatite)	(3)	(3)	[2] 2,000,000	(3)	(3)
United States (sold or used by producers)	3,817,368	4,066,943	4,764,921	4,718,780	5,208,508
World production (estimate)	11,500,000	9,800,000	(3)	(3)	(3)

[1] In addition to countries listed Angaur Island, Austria, Belgium, Brazil, Estonia, France, Germany, Italy, Japan, New Caledonia, New South Wales, Philippine Islands, Poland, Rumania, and Taiwan produce phosphate rock, but data of output are not available.

[2] Estimate.

[3] Data not available. For 1939 and 1940, estimate included in total.

[4] Exports.

[5] Including exports of 1,465,673 tons.

[6] Exports during fiscal year ended June 30 of year stated.

TECHNOLOGIC DEVELOPMENTS

Papers on various developments in phosphate-rock technology that have been published in recent months are listed below.[18]

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[17] Horner, C. K., Phosphate Rock in French North Africa: Bureau of For. and Dom. Commerce, Foreign Commerce Weekly, vol. 11, No. 12, June 19, 1943, pp. 3-8, 38-39.

[18] Walthall, J. H., and Bridger, G. L., Fertilizer by Fusion of Rock Phosphate with Olivine: Ind. and Eng. Chem., ind. ed., vol. 35, 1943, pp. 774-777.

Fox, E. J., and Clark, K. G., The Chlorophosphate Process for Dicalcium Phosphate: Ind. and Eng. Chem., ind. ed., vol. 35, 1943, pp. 1264-1268.

Hill, W. L., Faust, G. T., and Hendricks, S. B., Polymorphism of Phosphoric Oxide: Jour. Am. Chem. Soc., vol. 65, 1943, pp. 794-802.

Johnson, H. B., Recovery of Valuable Materials by Electrostatic Separation: Chem. and Met. Eng., vol. 50, No. 11, November 1943, pp. 130-133.

Lathe, F. E., Wright, L. E., Leahey, A., and Turner, R. C., The Utilization of Phosphatic Open-Hearth Slag. Part I. Effect of Rapid Cooling on the Solubility of Phosphoric Acid by F. E. Lathe. Wright, L. E., Leahey, A., and Turner, R. C. Part II. The Availability of Phosphoric Acid as Measured by Yield and Phosphorus Recovery in Barley and Clover: Jour. Soc. Chem. Ind., vol. 62, No. 2, February 1943, pp. 24-28.

Jernstedt, George, New Phosphate Coatings with Unusual Corrosion-Resistance: Trans. Electrochem. Soc., vol. 83, 1943, 13 pp.

Brown, B. E., An Appraisal of Different Phosphatic Materials as Sources of Phosphorus for Crop Plants: A Greenhouse Study: Am. Fertilizer, vol. 98, No. 6, March 13, 1943, pp. 10-11.

Brown, B. E., and Clark, K. G., An Appraisal of Calcium and Potassium Metaphosphates as Sources of Phosphorus for Crop Plants: Am. Fertilizer, vol. 98, No. 5, February 27, 1943, pp. 10-11, 24, 26.

SUPERPHOSPHATES

Superphosphate, as a phosphatic fertilizer itself and also as the phosphate-bearing component in mixed and complete fertilizers, has naturally responded to the great war demand for fertilizers, now the highest of all time. Production and sales have increased much above pre-war times, and the industry has taken greatly augmented quantities of phosphate rock to produce the quantities needed. Imports of normal and concentrated superphosphates have declined; but in 1943, imports of the ammoniated variety, although small, were greater than in the previous 2 years. Exports markedly increased in 1943 over 1942, owing to larger shipments to Canada and the United Kingdom.

The following tables give outstanding features of the superphosphate industry of the United States in recent years.

Salient statistics of the superphosphate industry in the United States, 1941–43

	1941	1942	1943
Production [1] short tons	4,326,402	5,144,484	6,292,955
Shipments,[1] total do	3,633,871	3,961,362	3,935,293
To mixers do	1,638,026	1,916,772	3,935,293
To other acidulators (including exchange transfers) do	659,514	541,225	
To all others (including Government agencies) do	1,336,331	1,503,365	
Stocks in manufacturers' hands, Dec. 31 [1] do	932,683	[2] 973,224	791,385
Exports of superphosphates [3] long tons	146,875	165,092	239,779
Imports of superphosphates [3] do	17,368	16,659	2,554
Sales of phosphate rock by producers for superphosphate production long tons	2,825,456	3,242,689	3,631,786

[1] Bureau of the Census, Monthly Statistics, Superphosphate Industry, 18 percent available phosphoric acid.

[2] Stocks of 1,008,139 short tons shown at beginning of January 1943, in the Monthly Statistics for that month.

[3] U. S. Department of Commerce.

Superphosphates (acid phosphates) exported from the United States, 1942–43, by countries

Country	1942		1943	
	Long tons	Value	Long tons	Value
Africa: British East Africa	2,679	$52,500	2,107	$73,660
Brazil	123	11,014	6,099	109,329
British Guiana	150	3,525	-------	-------
Cameroon	10	394	116	6,141
Canada	64,626	999,803	95,089	1,738,201
El Salvador	270	6,004	308	7,410
India and Dependencies	-------	-------	149	6,415
Mexico	110	6,000	-------	-------
United Kingdom [1]	80,536	3,601,014	124,782	5,009,863
Venezuela	3	342	133	3,735
West Indies:				
British:				
Bahamas	1	12	139	2,725
Leeward Islands	-------	-------	400	10,297
Trinidad and Tobago	125	1,625	202	4,087
Other British	-------	-------	54	1,342
Cuba	16,411	196,650	10,077	216,018
Haiti	4	220	4	67
Other countries	44	2,960	120	4,846
	165,092	4,882,063	239,779	7,194,136

[1] United Kingdom of Great Britain and Northern Ireland.

Superphosphates (acid phosphates) imported for consumption in the United States, 1941–43, by classes [1]

Class	1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value
Normal (standard) (not over 25 percent P_2O_5 content)	12,017	$172,990	5,965	$80,409	252	$4,678
Concentrated (treble) (over 25 percent P_2O_5 content)	5,333	133,835	10,694	300,342	2,242	63,515
Ammoniated	18	376			60	3,698
	17,368	307,201	16,659	380,751	2,554	71,891

[1] All from Canada.

Several articles relating to the superphosphate industry appeared in 1943.[19]

BASIC SLAG

No recent figures for the production of basic slag are available, either for the United States or for foreign countries. Only 3 long tons were imported into this country in 1943.

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[19] Brand, C. J., Fertilizers and Fertilizer Chemicals in Wartime: Chem. and Eng. News, vol. 21, 1943, pp. 1788–1792.

Kieffer, D. C., Potash and Superphosphate Supplies and Problems: Nat. Fertilizer Assoc., Proc. 19th Ann. Convention, 1943, pp. 18–25.

Chemical and Metallurgical Engineering, Superphosphate Production: Vol. 50, No. 4, April 1943, pp. 132–135.

Hardesty, J. O., Adams, W. H., and Adams, J. R., Factors Affecting the Availability of Ammoniated Superphosphates—Part I: Am. Fertilizer, vol. 98, No. 13, June 19, 1943, pp. 5–8, 24, 26.

Brown, B. E., Campbell, J. C., Hawkins, Arthur, Houghland, G. V. C., and Jacob, K. D., An Evaluation of Sludge-Acid and Alkylation-Acid Superphosphates as Sources of Phosphorus in Potato Fertilizers: Am. Potato Jour., vol. 20, No. 4, April 1943, pp. 89–95.

Reynolds, D. S., Pinckney, R. M., and Hill, W. L., Water Solutions of Superphosphate as a Low-Fluorine Source of Phosphorus: Jour. Assoc. Off. Agric. Chemists, November 1943, pp. 564–575.

TALC, PYROPHYLLITE, AND GROUND SOAPSTONE[1]

By Bertrand L. Johnson and F. M. Barsigian

SUMMARY OUTLINE

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General conditions	1431	Prices	1434
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Post-war outlook	1433	Foreign trade	1436
Sales	1433	World production	1438
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GENERAL CONDITIONS

Increases in demands from paint, rubber, paper, insecticide, and foundry-facings industries for talc, pyrophyllite, and ground soapstone raised both mined production and sales in 1943 to levels higher than those of 1942. Sales gained 6 percent and the total value 8 percent, setting a new high record. (See fig. 1.) Only sales of crude material decreased in quantity, and only the sales of ground products increased in value. Imports declined in 1943, although the quantity

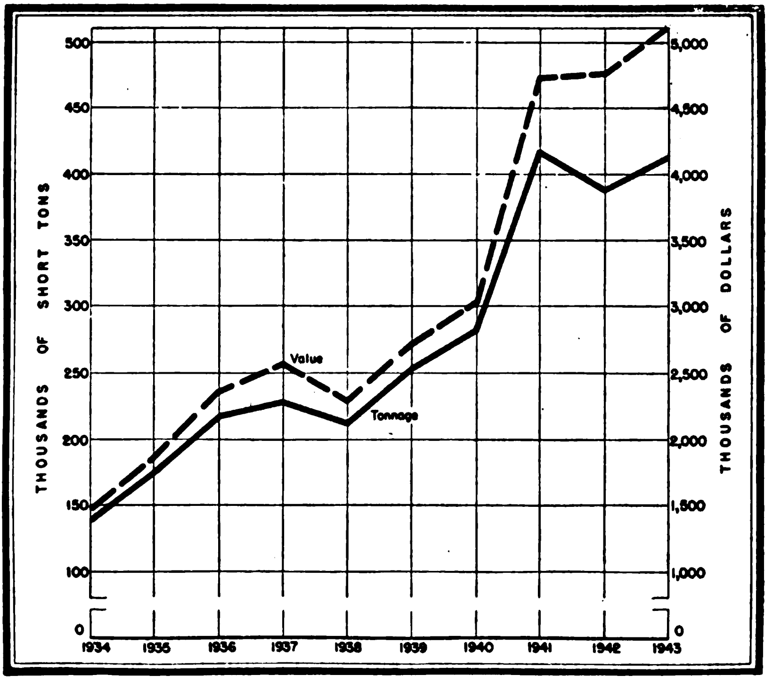

FIGURE 1.—Sales of domestic talc, pyrophyllite, and ground soapstone, 1934–43.

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[1] Soapstone sold in slabs or blocks is included in the chapter on Stone.

of crude brought in was higher than in 1942. Exports were higher in both quantity and value.

Pyrophyllite is included with talc in this chapter because of its resemblance to talc in certain physical properties and because it is interchangeable with talc in some uses, although during recent years certain specialized uses for pyrophyllite have been developed. It is a hydrous aluminum silicate, whereas talc is a hydrous magnesium silicate. Production and sales figures for pyrophyllite for 2 years are now available.

Salient statistics of the talc, pyrophyllite,[1] and ground-soapstone industries in the United States, 1942–43

	1942		1943	
	Short tons	Value	Short tons	Value
Mined:				
Total	403, 801	(2)	436, 249	(2)
Used by producers	354, 126	(2)	382, 668	(2)
Sold by producers:				
Crude	[3] 33, 837	[3] $303, 166	30, 200	$289, 563
Sawed and manufactured	1, 505	370, 631	1, 669	316, 973
Ground	352, 621	4, 080, 279	380, 999	4, 514, 878
	387, 963	4, 754, 076	412, 868	5, 121, 414
Imports for consumption:[4]				
Crude and unground steatite and French chalk	286	5, 753	408	12, 195
Cut and sawed	(5)	36	1	40
Ground, washed, or pulverized	8, 492	94, 687	6, 089	62, 949
	8, 778	100, 476	6, 498	75, 184
Exports:				
Talc, steatite, soapstone, and pyrophyllite, crude and ground	9, 246	191, 900	10, 693	236, 268
Powder—talcum (in packages), face, and compact	(6)	678, 313	(6)	756, 024
	....	870, 213	....	992, 292

[1] In 1942: Mined, 53,247 short tons. Sold—crude, 6,440 tons, $35,790; ground, 47,229 tons, $379,026; total, 53,669 tons, $414,816. In 1943: Mined, 64,198 short tons. Sold—crude, 5,432 tons, $34,306; ground, 56,710 tons, $460,485; total, 62,142 tons, $494,791.

[2] Data not available.

[3] Includes pinite from Nevada.

[4] Exclusive of "manufactures, n. s. p. f., except toilet preparations," as follows: 1942, $2,704; 1943, $20. Quantities not available.

[5] Less than 1 ton.

[6] Quantity not recorded.

Twelve States reported sales of talc, pyrophyllite, or ground soapstone in 1943. Alabama, which entered the ranks of talc producers in 1942, had no production in 1943, nor was any pinite reported from Nevada. The Eastern States furnished 81 percent of total domestic sales in 1943.

Steatite talc has been controlled by War Production Board Conservation Order M–239, issued October 13, 1942. This order was amended February 6, 1943, and on April 29, 1943. The order was revised again on March 28, 1944, when inventory restrictions on steatite talc were relaxed; whereas those on other talcs were unchanged, except for New York State varieties, which were made more rigid.

The Metals Reserve Co. stock-piled steatite talc in 1943.

A description of a talc deposit in Nevada was published during the year.[2]

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[2] Bureau of Mines, Reed Talc Property, Esmeralda County, Nevada: War Minerals Report 115, 1943, 7 pp.

POST-WAR OUTLOOK

The wide diversity of uses of talc, pyrophyllite, and ground soapstone undoubtedly will cushion any decline in total production and sales resulting from the cessation of World War II. Sales for certain war-stimulated uses, such as nonreflecting paints, radio insulators, insecticides, and foundry facings, may be expected to drop considerably, but sales for many other uses of these commodities may increase with the return to a peacetime economy. Competition of foreign talcs unquestionably will be felt from a revived import trade in talc of steatite and cosmetic grades.

SALES

In 1943, both the quantity and value of domestic talc, pyrophyllite, and ground soapstone sold or used were greater than in 1942, according to the report of the producers to the Bureau of Mines, but the tonnage did not equal that sold or used in 1941; the total value, however, because of an increase in the average value, reached a new all-time record of over 5 million dollars.

Talc, pyrophyllite,[1] *and ground soapstone sold by producers in the United States, 1939–43, by classes*

Year	Crude			Sawed and manufactured		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
1939	15,722	$82,188	$5.23	1,871	$77,915	$41.64
1940	[2] 17,724	[2] 118,424	[2] 6.68	1,894	140,565	74.22
1941	[2] 43,823	[2] 393,839	[2] 8.99	4,186	308,467	73.69
1942	[2] 33,837	[2] 303,166	[2] 8.96	1,505	370,631	246.27
1943	30,200	289,563	9.59	1,669	316,973	189.92

Year	Ground			Total		
	Short tons	Value at shipping point		Short tons	Value at shipping point	
		Total	Average		Total	Average
1939	236,383	$2,540,731	$10.75	253,976	$2,700,834	$10.63
1940	261,757	2,749,331	10.50	281,375	3,008,320	10.69
1941	368,360	3,999,586	10.86	416,369	4,701,892	11.29
1942	352,621	4,080,279	11.57	387,963	4,754,076	12.25
1943	380,999	4,514,878	11.85	412,868	5,121,414	12.40

[1] In 1942: Crude, 6,440 tons, $35,790; ground, 47,229 tons, $379,026; total, 53,669 tons, $414,816. In 1943: Crude, 5,432 tons, $34,306; ground, 56,710 tons, $460,485; total, 62,142 tons, $494,791.

[2] Includes pinite from Nevada.

Sales by States.—In 1943, New York remained the leading producer. Its sales were more than double those of any other State but were slightly less than in 1942. The total quantity of North Carolina talc, pyrophyllite, and ground soapstone sold or used in 1943 was 15 percent above 1942 and exceeded the previous high in 1941. Georgia also made a new high record in sales in 1943, 18 percent above the high mark of 1942. Sales from California increased 12 percent but remained below the record high of 1941. North Carolina was the only State marketing pyrophyllite; the quantity sold or used in 1943 exceeded that of 1942.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1942–43, by States

State	1942		1943	
	Short tons	Value	Short tons	Value
California	51,649	$678,906	58,003	$912,291
Georgia	29,030	464,160	35,210	396,031
Maryland	15,294	144,707	(1)	(1)
Nevada	[2] 12,339	[2] 236,033	11,791	171,351
New York	136,752	1,886,678	136,291	2,003,080
North Carolina [3]	56,909	503,082	65,698	580,106
Vermont	58,695	659,314	56,458	658,471
Washington	7	2,864	1,998	11,822
Other States [4]	26,388	178,332	47,419	388,262
	[3] 387,963	[3] 4,754,076	[3] 412,868	[3] 5,121,414

[1] Included under "Other States"; Bureau of Mines not at liberty to publish figures separately.

[2] Includes pinite.

[3] Includes pyrophyllite from North Carolina as follows: 1942, 53,669 tons, valued at $414,816; 1943, 62,142 tons, valued at $494,791.

[4] 1942: Alabama, Montana, New Mexico, Pennsylvania, and Virginia. 1943: Maryland, Montana, New Mexico, Pennsylvania, and Virginia.

MARKETS

Six industries—paint, ceramics, rubber, roofing, paper, and insecticides—took 81 percent of the domestic sales of talc, pyrophyllite, and ground soapstone in 1943, according to reports from producers to the Bureau of Mines. Of these six, the rubber and insecticide industries alone showed percentage increases. Quantitatively the paint, rubber, paper, and insecticide industries increased their consumption.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1942–43, by uses

Use	1942		1943	
	Short tons	Percent of total	Short tons	Percent of total
Paint	125,518	32	129,238	31
Ceramics	48,372	13	47,900	12
Rubber	40,487	10	48,994	12
Roofing	48,870	13	47,500	12
Paper	30,440	8	34,449	8
Toilet preparations	18,902	5	17,682	4
Insecticides	15,810	4	24,462	6
Foundry facings	7,822	2	10,348	3
Crayons	1,474	(1)	1,446	(1)
Other uses reported [2]	27,631	7	29,528	7
Use not reported	22,637	6	21,321	5
	[3] 387,963	100	412,868	100

[1] Less than 0.5 percent.

[2] 1942: Refractory, chemical war service, insulation, plastics, bleaching, textile, lubricants, and other minor uses; 1943: Chemical war service, refractory, plaster, insulation, bleaching, mine dust, textile, and other minor uses.

[3] Includes pinite.

PRICES

Quoted prices on ground domestic talc per ton, f. o. b. works, have not changed from those given in the Talc, Pyrophyllite, and Ground

Soapstone chapter in Minerals Yearbook, 1942 (p. 1385). According to the Oil, Paint and Drug Reporter of May 8, 1944, these prices were:

California: $17.50 to $43.
New York:
  Fibrous, coarse, off color, $13.
  Fine, 325-mesh, 93 to 94 percent, $13 to $18; 98 to 99.5 percent, $15.25 to $19.25; 99.85 to 99.95 percent, $17 to $21.
Pennsylvania: $11 to $13.50.
Vermont: $14.
Canadian talc, bags, carlots, per ton, $24 to $30.

The prices on pyrophyllite quoted in the same journal were: Standard, 200-mesh, carlots, paper bags, mines, per ton, $10; 325-mesh, same basis, ton, $13; No. 3, 200-mesh, carlots, mines, ton, $8; 325-mesh, same basis, $11.

In an amendment to MPR No. 188 effective December 8, 1943, the Office of Price Administration authorized producers making sales of pyrophyllite and purchasers for resale to add not exceeding 40 cents per net ton to their established maximum f. o. b. prices. (Amendment 20 to Order A–1 under Maximum Price Regulation No. 188.)

On January 15, 1944, producers of talc and ground soapstone, including crayons, who are unable to maintain production under existing maximum prices were provided a method of applying for increased ceiling prices whenever a shortage exists or threatens. (Office of Price Administration, Amendment 10 to Order A–2 under Section 1499.159b of Maximum Price Regulation No. 188, effective January 15, 1944.)

The average values of all grades of talc, pyrophyllite, and ground soapstone in the past 5 years, as reported to the Bureau of Mines by producers, are given in the table under Sales.

DEVELOPMENTS IN THE INDUSTRY

A comprehensive study of pyrophyllite issued by the R. T. Vanderbilt Co.[3] presents the results of an investigation of pyrophyllites from its deposits at Glendon, Staley, and Stem, N. C., and points out the essential differences in the various types and the properties that make them suitable for use in whitewares.

According to Goudge,[4] experiments are now under way in the laboratories of the Canadian Bureau of Mines to develop the use of magnesia from brucite as a substitute for talc in special porcelain bodies that possess a low coefficient of thermal expansion and to ascertain its suitability for enriching steatite electrical insulation bodies in magnesia.

Ultra-violet light has been used [5] for the rapid evaluation of samples of talc.

Talc has recently been suggested as a fertilizer material for use in supplying magnesium to soils deficient in that element.

A standard for the production of identical steatite radio insulators has been adopted, which covers procurement methods, standard practices, manufacturing tolerances, and other factors.[6]

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[3] R. T. Vanderbilt Co., Pyrophyllite: New York, 1943, 24 pp.

[4] Goudge, M. F., Brucite Magnesia: Jour. Am. Ceram. Soc., vol. 27, No. 1, January 1, 1944, pp. 8–10.

[5] Chemical Age, Mineral Analysis by U. V.: Vol. 49, No. 1254, July 10, 1943, p. 38.

[6] Wilsey, H. R., Second War Standard in Series Covers Steatite Radio Insulators (C 75.2–1943): Ind. Standardization, vol. 14, No. 10, 1943, pp. 273–275.

Siegal, Smith, and Greenburg[7] have made studies of the dust hazards at the tremolite-talc mines and mills of St. Lawrence County, N. Y.

Ueltz[8] has presented the results of a study of certain steatite bodies.

A recent comprehensive report by Stone[9] on ceramic materials for radio use includes data on raw materials for steatite ceramic insulators, their location, mining, and milling; thermal decomposition of talc; physical chemistry of steatite body composition, practical insulator-body compositions, and the processes of manufacture of the insulator bodies.

In another paper, Stone[10] discusses the physical changes of steatite ceramics under firing conditions.

Semmelman and Watts[11] and Lennon and Watts[12] presented the results of studies involving the use of talc in steatite porcelains.

Kane and Ueltz[13] reported the results of a study of iron-bearing talcs from Georgia, Maryland, Alabama, New York, and California, and soapstone from Vermont.

Western talcs—from California, Nevada, and Montana—were discussed by Roff.[14]

The use of the electron microscope in studying steatite ceramics is described by Kedesdy.[15]

A detailed description of the mining and treatment of talc by the three companies operating in northern Georgia is given by Hubbell[16] in an article published late in 1942.

Several papers[17] have been published dealing with the investigation by the Bureau of Mines of domestic talc resources for a grade suitable for the manufacture of ceramic radio insulators. A few talcs in various localities were found to be of proper grade as they occurred, but most of the samples required beneficiation.

FOREIGN TRADE[18]

Imports.—The declining trends of recent years in quantity and value of total imports of talc, steatite or soapstone, and French chalk continued in 1943, a decrease of 26 percent being recorded in the quantity and 25 percent in value from corresponding 1942 figures. As usual the imports were nearly all of materials "ground, washed, powdered, or pulverized, except toilet preparations;" these came from Canada and India. (See fig. 2.)

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[7] Siegal, William, Smith, A. R., and Greenburg, Leonard. Study of Talc Miners and Millers: Industrial Hygiene, Division of Industrial Hygiene, New York State Dept. of Labor. Reprints from Industrial Bull., vol. 22, No. 11, November 1943, and No. 12, December 1943.

[8] Ueltz, H. F. G., Crystalline and Glassy Phases of Steatite Dielectrics: Jour. Am. Ceram. Soc., vol. 27, No. 2, Feb. 1, 1944, pp. 33–39.

[9] Stone, R. L., Ceramic Dielectric and Insulator Materials for Radio and Radar Instruments: North Carolina State College of Agriculture and Engineering, Eng. Exp. Sta. Bull. 25, 1943, 63 pp.

[10] Stone, R. L., Physical Chemistry of Firing Steatite Ceramics: Jour. Am. Ceram. Soc., vol. 26, No. 10, October 1, 1943, pp. 333–336.

[11] Semmelman, J. O., and Watts, A. S., Study of the Firing Behavior of the Clinoenstatite Field Employing Talc Minerals, Magnesia, and Silica: Part I, Research in Steatite Porcelains in Ohio State Univ. Studies, Eng. Exp. Sta. Bull. No. 117, 1943, pp. 1–26.

[12] Lennon, J. W., and Watts, A. S., Study of the Talc Minerals in Steatite Bodies: Part II of Research in Steatite Porcelains in Ohio State Univ. Studies, Eng. Exp. Sta. Bull. No. 117, 1943, pp. 27–47.

[13] Kane, L. E., and Ueltz, H. G., Possible Use of Ferruginous Talcs in Steatite Dielectrics: Jour. Am. Ceram. Soc., vol. 26, No. 11, November 1, 1943, pp. 389–392.

[14] Roff, W. W., Western Talcs: Bull. Am. Ceram. Soc., vol. 22, No. 8, August 15, 1943, pp. 292–295.

[15] Kedesdy, H., Electron Microscope Investigation of Firing Phenomena in Talc and Steatite: Ber. Deut. Keram. Ges., vol. 24, 1943, pp. 201–282. Abstr. in Ceram. Abst., vol. 23, No. 3, 1944, pp. 54–55.

[16] Hubbell, A. H., Talc From North Georgia: Eng. and Min. Jour., vol. 143, No. 11, November 1942, pp. 45–49.

[17] Klinefelter, T. A., O'Meara, R. G., Smith, R. W., and Truesdell, G. C., Talcs for Use in Radio Ceramic Insulators: Am. Inst. Min. and Met. Eng., Tech. Pub. 1606, 5 pp. (Mining Technology, September 1943).

Klinefelter, T. A., Domestic Talcs: Bull. Am. Ceram. Soc., vol. 22, No. 7, July 15, 1943, pp. 225–227.

Berkelhamer, L. H., Petrographic Study of Domestic Talcs: Bull. Am. Ceram. Soc., vol. 22, No. 7, July 15, 1943, pp. 227–230.

Gottlieb, Sidney, Beneficiation of Domestic Talcs: Bull. Am. Ceram. Soc., vol. 22, No. 7, July 15, 1943, pp. 223–225.

Speil, Sidney, Physical Testing of Talc for High-Frequency Ceramics: Jour. Am. Ceram. Soc., vol. 26, No. 10, October 1, 1943, pp. 336–338.

[18] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Department of Commerce.

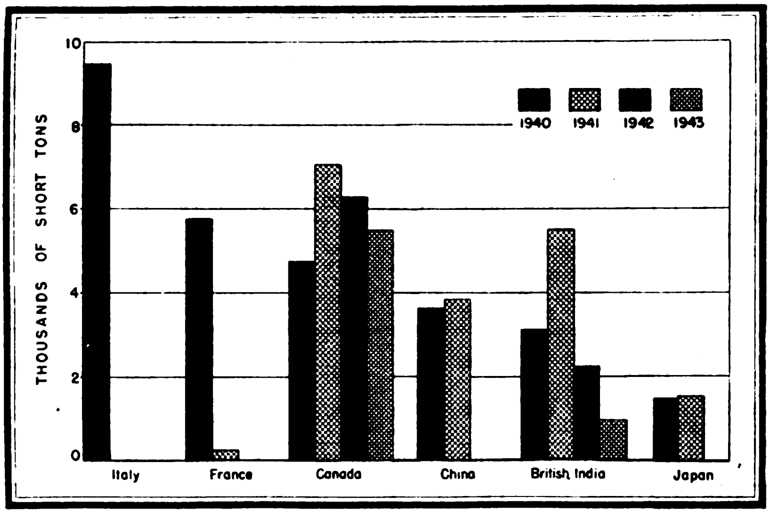

FIGURE 2.—Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1940–43, by leading countries.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1939–43, by classes

Year	Crude and unground		Ground, washed, powdered, or pulverized, except toilet preparations		Cut and sawed		Total		Manufactures, n. s. p. f., except toilet preparations	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	133	$2, 392	25, 943	$408, 178	94	$14, 651	26, 170	$425, 221	98	$27, 398
1940	93	1, 479	28, 145	465, 049	125	20, 739	28, 363	487, 267	(1)	21, 568
1941	341	5, 780	18, 225	225, 857	71	10, 611	18, 637	242, 248	(1)	11, 701
1942	286	5, 753	8, 492	94, 687	(2)	36	8, 778	100, 476	(1)	2, 704
1943	408	12, 195	6, 089	62, 949	1	40	6, 498	75, 184	(1)	20

[1] Quantity not recorded.
[2] Less than 1 ton.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1942–43, by classes and by countries

Country	Crude and unground		Ground, washed, powdered, or pulverized, except toilet preparations		Cut and sawed		Total		Manufactures, n. s. p. f., except toilet preparations (value)
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1942									
Canada			6,301	$62,222			6,301	$62,222	$7
China									510
Hong Kong									2,186
India and Dependencies	286	$5,753	1,963	28,863			2,249	34,616	1
Japan			9	259	(1)	$36	9	295	
United Kingdom [2]			219	3,343			219	3,343	
	286	5,753	8,492	94,687	(1)	36	8,778	100,476	2,704
1943									
Brazil	5	160			1	40	6	200	
Canada			5,547	55,757			5,547	55,757	
China									12
India and Dependencies	403	12,035	542	7,192			945	19,227	
United Kingdom [2]									8
	408	12,195	6,089	62,949	1	40	6,498	75,184	20

[1] Less than 1 ton.
[2] United Kingdom of Great Britain and Northern Ireland.

Steatite-talc imports are controlled by General Imports Order M–63.

Exports.—The quantity of "talc, steatite, soapstone, and pyrophyllite, crude and ground" exported from the United States was greater in 1943 than in 1942 but failed to reach the all-time record of 1941, but the value in 1943 was considerably greater than in 1941. The value of "powders—talcum (in packages), face, and compact" exported in 1943 was more than that of 1942.

Talcum and other powders exported from the United States, 1939–43

Year	Description	Short tons	Value	
			Total	Average
1939	Talc, steatite, and soapstone, crude and ground	9,047	$162,426	$17.95
	Powders—talcum (in packages), face, and compact	(1)	1,115,176	
1940	Talc, steatite, and soapstone, crude and ground	9,402	167,992	17.87
	Powders—talcum (in packages), face, and compact	(1)	945,530	
1941	Talc, steatite, soapstone, and pyrophyllite, crude and ground	10,889	216,440	19.88
	Powders—talcum (in packages), face, and compact	(1)	1,229,280	
1942	Talc, steatite, soapstone, and pyrophyllite, crude and ground	9,246	191,900	20.75
	Powders—talcum (in packages), face, and compact	(1)	678,313	
1943	Talc, steatite, soapstone, and pyrophyllite, crude and ground	10,693	236,268	22.10
	Powders—talcum (in packages), face, and compact	(1)	756,024	

[1] Quantity not recorded.

WORLD PRODUCTION

The few figures available for the production, by countries, of talc, pyrophyllite, and ground soapstone in recent years are shown in the following table:

World production of talc, pyrophyllite, and soapstone, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina	208	80	303	1,168	1,975	4,950	(2)
Australia:							
New South Wales	526	597	(2)	(2)	(2)	(2)	(2)
South Australia	991	973	1,115	1,349	2,972	(2)	(2)
Tasmania	------	------	------	(2)	(2)	(2)	(2)
Canada	[3] 11,301	[3] 9,846	[3] 11,924	21,583	31,417	27,096	22,811
China (Manchuria) (exports)	111,140	81,215	93,772	[4] 72,495	(2)	(2)	(2)
Egypt	2,266	1,251	833	2,212	5,229	1,875	2,054
Finland	881	(2)	(2)	(2)	(2)	(2)	(2)
France	56,300	(2)	(2)	(2)	(2)	(2)	(2)
Germany:							
Austria (exports)	14,089	5,625	(2)	(2)	(2)	(2)	(2)
Bavaria	7,790	6,805	(2)	(2)	(2)	(2)	(2)
Greece	1,838	1,293	1,003	(2)	(2)	(2)	(2)
India, British	13,249	18,888	22,616	(2)	(2)	(2)	(2)
Indochina	428	------	400	305	(2)	(2)	(2)
Italy	45,714	53,511	(2)	(2)	(2)	(2)	(2)
Morocco, French (exports)	841	1,702	(2)	(2)	(2)	(2)	(2)
Newfoundland	(2)	1,605	(2)	284	508	(2)	(2)
Norway	24,701	23,703	(2)	(2)	(2)	(2)	(2)
Rumania	1,976	2,256	(2)	(2)	(2)	(2)	(2)
Spain [5]	3,021	8,438	(2)	28,643	29,148	(2)	(2)
Sweden	7,937	6,797	7,195	(2)	(2)	(2)	(2)
Tanganyika Territory	------	38	5	6	(2)	(2)	(2)
Union of South Africa: Transvaal	376	1,554	449	1,757	[4] 1,379	1,985	[4] 4,094
United States [6]	208,650	193,025	230,402	255,258	377,722	351,952	374,546
Uruguay (exports)	437	952	1,111	1,699	1,867	[7] 2,192	(2)

[1] In addition to countries listed, talc or pyrophyllite is reported produced in Brazil, Bulgaria, U. S. S. R. and Western Australia, but data on production are not available.
[2] Data not available.
[3] Excludes soapstone, which is reported only by value and was as follows: 1937, $40,513; 1938, $35,038; 1939, $41,471. Soapstone is sold in the form of both blocks and powder.
[4] January to September, inclusive.
[5] Includes steatite, as follows—1937: 500 tons; 1938: 3,480 tons; 1940: 17,191 tons; 1941: 18,948 tons.
[6] Talc, pyrophyllite, and ground soapstone sold by producers; includes also pinite in 1940, 1941, and 1942.
[7] January to June, inclusive.

Canada.—Canadian talc and soapstone developments in 1942 have been described as follows:[19]

> The entire talc and soapstone production of Canada has for some years past come from Ontario and Quebec. More than 90 percent of the total output of talc to the end of 1942, however, came from the Madoc area, Hastings County, Ontario, which supplies ground talc of good white colour, while Quebec produces mainly a grey, off-colour grade. Quebec is the only producer of cut soapstone blocks and bricks and of sawed crayons.
>
> Development of the Madoc deposits commenced about 1900 and total output to date is estimated to have been about 400,000 tons. Since 1937, Canada Talc Limited, operating the Conley mine, has furnished most of the supply. * * *. Production is at the rate of about 15,000 tons a year. * * *. In 1941, Trent Mining Syndicate commenced development on a property adjoining the Conley mine and erected a small mill, but was inactive during most of 1942. W. C. Spry (Victory Talc) continued to grind a small tonnage of off-colour talc in the mill of the Canada Slate Products about a mile north of Madoc, the crude rock being obtained from a deposit near Ompah, Frontenac County. * * *.
>
> Quebec has been producing cut soapstone since 1922, mainly in the form of blocks and bricks for the alkali recovery furnaces of domestic kraft mills. The sawing of crayons was commenced a few years ago. The industry is centered in the Thetford Mines district, Eastern Township, where Broughton Soapstone & Quarry Co. is the principal operator. This company operates two soapstone quarries near Leeds station in Broughton Township and, in addition to turning out cut stone and crayons, produces most of the ground talc made in the province. Other smaller operators in the same district are Charles Fortin, of Robertson, and L. C. Pharo, of Thetford Mines, working in Thetford and Leeds Townships,

[19] Canada, Department of Trade and Commerce, The Talc and Soapstone Industry, 1942: Dominion Bureau of Statistics, Mining, Metallurgical, and Chemical Branch, Ottawa, Canada, 1943. (Data from report by the Bureau of Mines, Ottawa.)

> respectively. Some of the sawing dust from these operations is sold to domestic roofing firms, and a considerable tonnage of quarry and sawing waste is shipped to the grinding plant of Pulverized Products, Limited, 4820 Fourth Ave., Rosemount, Montreal. Total sales of cut stone from the district in 1942 were about 3,000 tons and of ground talc about 8,500 tons. Baker Mining & Milling Co., 4010 St. Catherine Street, West, Montreal, the only other operator in Quebec, has a mine and mill near Highwater in Brome county, close to the Vermont boundary. * * * Total production of ground talc in the Province in 1942 was nearly 14,000 tons.

Late in 1943,[20] development of a long-known deposit of lava-grade talc in the Kootenay National Park, British Columbia, was begun. This is said to be the only known source of lava-grade talc in Canada and belongs to the Canadian Government.

A flotation process devised by the Canadian Bureau of Mines renders possible the beneficiation of Madoc talc with the production of a talc that can be used in the manufacture of steatite insulators for high-frequency radio purposes.[21]

Formation of a Government-owned company, Canadian Steatite Co., Ltd., of Georgetown, Ontario, is reported, the entire output of which is to be used by the Government.[22]

Newfoundland.[23]—Important pyrophyllite deposits are known in Newfoundland, from which some shipments were made a few years ago to the grinding mill of Clinchfield Sand & Feldspar Corporation, Baltimore, Md. At present, the deposits are owned and operated by Industrial Minerals Co. of Newfoundland, Ltd., Box 435, St. Johns, which in 1942 installed a grinding plant with a capacity of 25 tons a day and shipped about 500 tons of ground material to Great Britain.

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[20] Northern Miner, Mining Lava Talc in B. C.: Vol. 29, No. 39, December 16, 1943, p. 107.
Canadian Chemistry and Process Industries, Lava Talc: Vol. 28, No. 1, January 1944, p. 17.

[21] Spence, H. S., Phillips, J. G., and Turrall, W. T., Canadian Talc for Use in Steatite Insulators: Paper presented at the Forty-fifth Annual Meeting, Am. Ceram. Soc., Pittsburgh, Pa., April 20, 1943. Bull. Am. Ceram. Soc., vol. 22, No. 8, August 15, 1943, pp. 295–298.

[22] Foreign Commerce Weekly (Bur. For. Dom. Com.), Canadian Government Forms Steatite Company: Vol. 13, No. 11, December 11, 1943, p. 26.

[23] Canada, Department of Trade and Commerce, The Talc and Soapstone Industry, 1942: Dominion Bureau of Statistics, Mining, Metallurgical, and Chemical Branch, Ottawa, Canada. 1943 (Data from report by the Bureau of Mines, Ottawa.)

FLUORSPAR AND CRYOLITE

By H. W. Davis[1]

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FLUORSPAR

SUMMARY

Despite the many difficulties of operation in 1943 the fluorspar industry established an impressive record in supplying the unprecedented demand for this mineral, which is essential in the manufacture of steel, aluminum, high-octane gasoline, insecticides, and many other commodities necessary for the successful prosecution of the war. Production and shipments (433,000 and 406,016 short tons, respectively) in 1943 were 28 and 13 percent greater than in 1942, the previous record year, and shipments were 54 percent more than in 1918, during World War I. Moreover, production and shipments were 11 and 4 percent, respectively, greater than consumption in 1943, which also reached an all-time high. Illinois not only maintained its rank as the chief producing State by shipping 23 percent more fluorspar than in 1942, the previous record year, but supplied 49 percent of the total shipments in 1943. Colorado and New Mexico also established new records in 1943. On the other hand, shipments from Kentucky declined for the second successive year and were 18 percent less than in 1942. Shipments by river or river-rail (49,913 tons) were 37 percent less than the all-time high of 1942. Imports in 1943 (43,570 tons) were 20 times those of 1942 and the largest since 1930. Exports—usually small—were only slightly higher than in 1942.

Despite the record production of fluorspar in 1943, the output of metallurgical grade lagged behind consumption during the first half of the year; consequently, inventories at consuming plants declined progressively until the end of June. Although supplies of fluorspar were not allocated, beginning January 1943 shipments of both metallurgical and ceramic grades were controlled by the War Production Board, which forbade any supplier to ship fluorspar to consumers having an inventory greater than a "practicable working minimum." Moreover, because of the scarcity of metallurgical-grade fluorspar, steel manufacturers were urged to use this grade sparingly and where possible to use flotation concentrates, the supply of which exceeded demand. That the domestic steel industry cooperated in complying with these requests is evidenced by the fact that the average consumption of fluorspar per long ton of basic open-hearth steel produced dropped from 6.4 pounds in 1942 to 5.9 pounds in 1943, and purchases of flotation concentrates totaled 3,638 tons. The flotation concentrates were used chiefly in basic electric steel furnaces. Some open-hearth operators experimented with flotation concentrates, but results were not entirely satisfactory, probably because of the fine size of the concentrates. Nevertheless, one operator found that a three-way mixture of 50 percent iron sinter, 30 percent gravel fluorspar, and 20 percent flotation concentrates proved satisfactory. The smaller consumption at steel plants resulted mainly from conservation measures, notwithstanding the fact that lower-grade fluorspar was used. Possible substitutes, such as ilmenite, sodium chloride, topaz, soda-ash briquets, and bauxite, were under study, but so far as known the use of these materials as substitutes for fluorspar was insignificant. However, it was reported that a considerable saving in fluorspar resulted from the increased use of roll scale. According to Norris,[2] "It appears at this time that the greatest saving of spar can be made by properly mixing fine roll scale with spar. Most heats can be shaped up with this mixture and at a net saving of spar."

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[1] Figures on imports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce; those on exports of fluorspar supplied by the producers.

Salient statistics of fluorspar in the United States, 1934–43, in short tons

Year	Shipments from domestic mines	Foreign trade		Consumption	Stocks at end of year			
		Imports for consumption	Exports		Consumers' plants	Domestic mines [1]	Government stockpile	Total
1934	85,786	16,705	522	110,600	57,600	50,586		108,186
1935	123,741	16,340	313	137,400	58,000	40,043		98,043
1936	176,877	25,504	240	182,400	72,600	29,958		102,558
1937	181,230	37,063	456	194,300	90,100	30,539		120,639
1938	80,403	19,622	788	115,100	71,800	34,996		106,796
1939	182,771	16,302	2,976	176,800	90,400	38,619		129,019
1940	233,600	11,873	8,482	218,500	102,100	43,866		145,966
1941	320,669	7,524	12,184	303,600	108,900	31,997		140,897
1942	360,316	2,151	9,020	360,800	96,000	19,429		115,429
1943	406,016	43,570	9,068	388,885	105,933	19,026	36,223	161,182

[1] Finished fluorspar only.

Contrary to expectation, the increase of $5 a ton in maximum prices for metallurgical-grade fluorspar, which became effective on November 23, 1942, did not stimulate production. Consequently, effective July 1, 1943, the base price was again advanced $5 a ton to $30 to $33, according to calcium fluoride and silica content. Concurrently, an average wage raise of about 24 percent was granted mine employees, and a uniform wage scale was put into effect for various classes of surface and mine labor in the Illinois-Kentucky district. The wage scale in Kentucky is 10 cents an hour less than in Illinois. Moreover, effective August 30, 1943, deliveries of the higher grades of metallurgical fluorspar were controlled by the War Production Board. These actions were followed by a marked improvement in production of metallurgical-grade fluorspar, which exceeded consumption for the remainder of 1943.

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[2] Norris, F. G., The Open-Hearth in 1943: Blast Furnace and Steel Plant, vol. 32, No. 1, January 1944, p. 75.

Production of ceramic and acid grades was more than adequate to meet requirements in 1943; however, the consumption of acid grade was advancing at a more rapid rate than production and was only slightly less than production during the latter half of 1943. The base prices for ceramic and acid grades were increased to $37 a ton on July 1, 1943.

Deliveries of fluorspar to consumers in the United States totaled 404,658 short tons in 1943 (388,902 tons from domestic mines and 15,756 tons from foreign sources); in addition, 35,884 tons of finished fluorspar (8,070 tons from domestic mines and 27,814 tons from foreign sources) were delivered to Government stock piles. In 1942 deliveries to consumers totaled 353,469 tons (351,300 tons from domestic mines and 2,169 tons from foreign sources); there were no deliveries to Government stock piles in 1942. Total deliveries to steel plants in the United States increased to 236,425 tons in 1943 from 225,502 tons in 1942, and those to domestic manufacturers of hydrofluoric acid advanced to 123,820 tons from 89,983 tons; sales to the glass and enamel trades declined moderately.

The average composite selling price ($29.35 a short ton) of all grades of fluorspar (both domestic and foreign) delivered to consumers in the United States was $4.69 more than in 1942 ($24.66). The average selling price of all grades of domestic fluorspar shipped in 1943 ($29.07) established a new peak and was $3.58 greater than the previous high of 1919. The average selling price, f. o. b. Illinois-Kentucky mines, of metallurgical-grade fluorspar shipped to domestic steel plants was $28.69 a ton ($23.82 in 1942) and of that shipped to domestic manufacturers of hydrofluoric acid $33.86 ($28.86 in 1942).

The total quantity of fluorspar shipped in and imported into the United States from about 1870 through 1943 was approximately 6,719,000 short tons, comprising 5,615,000 tons from domestic mines and 1,104,000 tons from foreign sources. It is noteworthy that of the total domestic shipments, 1,503,372 tons (27 percent) were shipped during the past 5 years (1939–43).

POST-WAR OUTLOOK

Consumption of fluorspar for several years after the war probably will be substantially greater than during the 5 pre-war years. The steel industry will, as heretofore, continue to influence profoundly the prosperity of the domestic fluorspar industry. Although some of the conservation measures effected during the war doubtless will be continued, it is believed unlikely that the average consumption of fluorspar per ton of steel produced will drop below that of 5.4 and 5.2 pounds, respectively, in 1939 and 1940. Although the production of steel will decline substantially with the ending of the war, many authorities believe that it will be maintained at a high level for some time. Should an annual average production of, say, 50,000,000 long tons of basic open-hearth and basic electric steels be maintained during the 5 post-war years an annual consumption of 145,000 to 150,000 short tons of fluorspar probably would be required.

Establishment of important new uses and a growing demand in some of the older uses for hydrofluoric acid have resulted in a large increase in consumption of fluorspar during the war. During the 2 years 1942–43 the average consumption of fluorspar in the manufacture of hydrofluoric acid was 97,600 tons as compared with an average of 32,500 tons during the 5 years 1937–41. Although consumption will decline after the war, it is likely to be substantially greater than during the 5 years 1937–41.

It is believed that the future requirements of ceramic grades will exceed those for 1937–41, which averaged 20,000 tons, and future consumption in the production of iron castings, ferro-alloys, primary and secondary nonferrous metals, cement, and other miscellaneous operations will be maintained at least at the pre-war level and may advance somewhat.

Consequently, an average consumption of 225,000 to 250,000 tons for several years after the war appears to be possible.

PRODUCTION AND SHIPMENTS

Production of finished fluorspar totaled 405,600 short tons in 1943, including 159,758 tons of flotation concentrates. In addition, 66,000 tons of crude ore, equivalent to 27,400 tons of finished fluorspar, were mined but not milled in 1943. Thus, total production (expressed in terms of finished fluorspar) was 433,000 tons in 1943 compared with 337,000 tons in 1942. Of the quantity produced in 1943, 12 mines producing over 10,000 tons each supplied 212,000 tons or 49 percent, 12 mines producing 5,000 to 10,000 tons each supplied 80,000 tons or 18 percent, and 35 mines producing 1,000 to 5,000 tons each supplied 90,000 tons or 21 percent; thus, 59 mines produced 382,000 tons or 88 percent of the total. The remainder (51,000 tons or 12 percent) was produced in quantities ranging from a few tons to 1,000 tons from an undetermined number of small mines and prospects and reclaimed from waste dumps and old workings of abandoned mines.

Fluorspar shipments from domestic mines in 1943 were the largest on record and aggregated 406,016 short tons valued at $11,802,255, representing increases of 13 percent in quantity and 33 percent in total value over 1942. Of the 1943 total, 49,913 tons were shipped by river or river-rail for delivery to consumers as compared with 79,049 tons (an all-time high) in 1942.

Illinois (49 percent) and Kentucky (27 percent) supplied 76 percent of the fluorspar shipped in 1943 compared with 82 percent in 1942 and 86 percent in 1941. Shipments from Illinois and Kentucky in 1943 gained only 4 percent over 1942 compared with an increase of 52 percent in the West.

The average value of all grades of finished fluorspar shipped in 1943 was $29.07 a short ton ($4.38 more than the 1942 average).

The following table shows shipments of fluorspar, by States, 1942 and 1943. (For historical table, see Minerals Yearbook, 1941, p. 1401.)

Shipments of fluorspar in 1943 comprised 226,461 tons of fluxing gravel and foundry lump, 158,724 tons of flotation concentrates, 20,263 tons of ground, and 568 tons of acid lump. The bulk of the fluxing-gravel and foundry-lump fluorspar was shipped to steel plants and iron foundries, but a comparatively small tonnage moved to plants making cement, ferro-alloys, nickel, basic refractories, and fluxing compounds, to smelters of secondary metals, and to the Government stock pile. Hydrofluoric-acid plants took 77 percent of the flotation con-

Fluorspar shipped from mines in the United States, 1942–43, by States

State	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Illinois	161,949	$4,306,750	$26.59	198,789	$6,292,789	$31.66
Kentucky	134,133	3,266,257	24.35	109,849	3,122,513	28.43
Colorado	31,743	640,938	20.19	49,145	1,164,868	23.70
New Mexico	23,291	530,025	22.76	37,050	986,094	26.62
Texas				960	19,281	20.08
Arizona				1,328	26,441	19.91
Washington	48	153,779	16.72	----------	----------	----------
Nevada	8,020			8,653	190,269	21.39
Utah	1,018			51		
Tennessee	114			57		
California	----------	----------	----------	134		
	360,316	8,897,749	24.69	406,016	11,802,255	29.07

centrates shipped in 1943; the remainder went to aluminum- and magnesium-reduction works, to steel, ferro-alloy, glass, enamel, and nickel plants, to smelters of secondary metals, and to the Government stock pile. Over two-thirds of the ground fluorspar was shipped to glass and enamel plants; the remainder moved chiefly to manufacturers of welding rods, magnesium, ferro-alloys, and steel and to smelters of secondary metals. Except for 20 tons to a steel plant and 1 ton to a nonferrous smelter, all the acid lump fluorspar was shipped to hydrofluoric-acid plants.

The next table shows shipments of fluorspar, by grades and industries, in 1943.

Fluorspar shipped from mines in the United States in 1943, by grades and industries

Grade and industry	Short tons
Fluxing gravel and foundry lump:	
Ferrous	215,530
Nonferrous	3,313
Cement	1,094
Miscellaneous	205
Government stock pile	4,374
Exported	1,945
	226,461
Acid lump:	
Ferrous	20
Nonferrous	1
Hydrofluoric acid	547
	568
Ground:	
Ferrous	95
Nonferrous	1,500
Glass and enamel	14,077
Hydrofluoric acid	1,150
Miscellaneous	3,006
Exported	435
	20,263
Flotation concentrates:	
Ferrous	[1] 13,351
Nonferrous	5,375
Glass and enamel	6,982
Hydrofluoric acid	121,983
Miscellaneous	673
Government stock pile	3,696
Exported	6,664
	158,724
Total:	
Ferrous	228,996
Nonferrous	10,189
Cement	1,094
Glass and enamel	21,059
Hydrofluoric acid	123,680
Miscellaneous	3,884
Government stock pile	8,070
Exported	9,044
	406,016

[1] Includes pelletized gravel.

SHIPMENTS, BY USES

The steel industry is the predominant purchaser of fluorspar, as is evident from the following table; it also consumes considerable hydrofluoric acid and sodium fluoride, in which fluorspar is the basic material.

Fluorspar shipped from mines in the United States, 1942–43, by uses

Use	1942				1943			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Total	Average	Percent of total	Short tons	Total	Average
Steel	62.51	225,233	$5,085,037	$22.58	54.38	220,809	$6,006,251	$27.20
Iron foundry	.95	3,408	65,073	19.09	.84	3,398	85,728	25.23
Glass	5.80	20,890	576,363	27.59	4.80	19,487	582,173	29.87
Enamel	.53	1,923	56,723	29.50	.39	1,572	50,620	32.20
Hydrofluoric acid	24.45	88,083	2,540,766	28.85	30.46	123,680	4,046,231	32.72
Miscellaneous	3.26	11,763	331,242	28.16	4.91	19,956	598,627	30.00
Government stock pile	-------	----------	------------	-------	1.99	8,070	185,652	23.01
	97.50	351,300	8,655,204	24.64	97.77	396,972	11,555,282	29.11
Exported	2.50	9,016	242,545	26.90	2.23	9,044	246,973	27.31
	100.00	360,316	8,897,749	24.69	100.00	406,016	11,802,255	29.07

USES

As figure 1 shows graphically, the steel industry is the chief consumer of fluorspar in the United States. Fluorspar is used as a flux in basic open-hearth and basic electric steel furnaces; a comparatively small quantity is employed in Bessemer-steel furnaces. The second-largest use is in the manufacture of hydrofluoric acid, which is utilized to make artificial cryolite and aluminum fluoride (aluminum raw materials), refrigerating mediums, and insecticides; hydrofluoric acid is also used in the electrolytic refining of metals, the pickling of metals, chromium plating, the processing of high-octane gasoline, and the etching of glassware, as well as for other purposes. The glass industry, which employs fluorspar as an opacifier and as a flux, ranks third in importance. The enamel industry uses fluorspar as an ingredient in frit; it formerly ranked fourth but dropped to tenth place in 1943. Comparatively small quantities of fluorspar are used in a number of miscellaneous operations, such as production of the finer grades of iron castings, chilled-iron rolls, primary and secondary nonferrous metals, cement, ferro-alloys, carbon electrodes, rock wool, basic refractory cements, and calcium carbide and cyanamid; as a paint pigment; as a binder for abrasives; in a formula for coating welding rods; as a boiler-cleaning compound; as a flux to deslag high-pressure generators; for stripping anodizing racks; as an ingredient in various types of fluxing compounds; and in the manufacture of surfacing for roofing.

One of the most important wartime developments in aviation-gasoline manufacture is the anhydrous hydrofluoric acid alkylation process, in which hydrogen fluoride is the catalyst instead of the usual sulfuric acid. Frey[3] has described this process. Another important wartime invention is the new aerosol dispenser for protection of the Army overseas from malaria mosquitoes, which uses Freon, a nonpoisonous gas employed for refrigerating systems. Both developments resulted in greatly increased demand for acid-grade fluorspar in 1943. Considerable publicity was given to the use of sodium fluoride to retard tooth decay.

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[3] Frey, F. E., Commercial Alkylation with Hydrogen Fluoride Catalyst: Chem. and Met. Eng., vol 50, No. 11, November 1943, pp. 126 and 128.

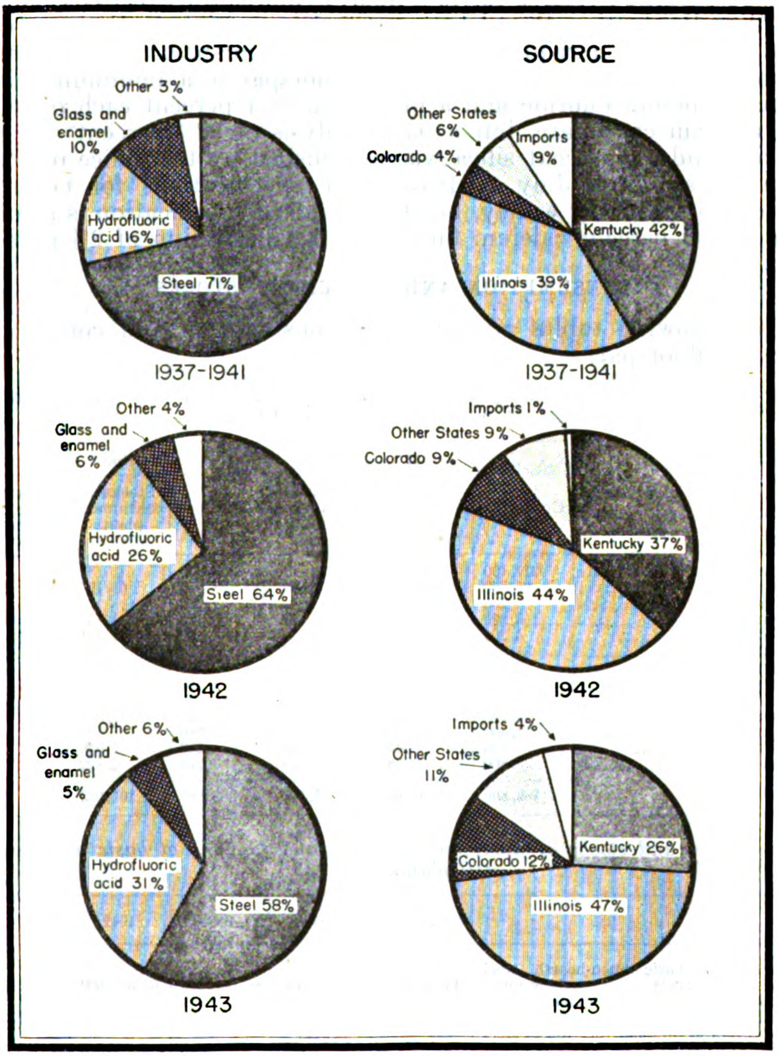

FIGURE 1.—Average annual fluorspar sales (domestic and foreign) to consumers in the United States, 1937-41, compared with 1942 and 1943, by consuming industries and by sources.

SPECIFICATIONS

The chief commercial grades of fluorspar are metallurgical, ceramic, and acid. The standard chemical specification for metallurgical grade is a minimum of 85 percent calcium fluoride and a maximum of 5 percent silica; it contains 72½ percent effective calcium fluoride. However, because of a scarcity of metallurgical-grade fluorspar in 1942, many consumers voluntarily accepted a lower-grade product.

Production of metallurgical-grade fluorspar continued to lag behind consumption during the first half of 1943, and as a consequence the Office of Price Administration, effective August 30, 1943, prohibited the sale or delivery of metallurgical-grade fluorspar containing more than 60 percent effective calcium fluoride unless the Steel Division of the War Production Board had certified in writing to the producer that the purchaser required a higher-grade fluorspar. The standard chemical specification for acid-grade fluorspar is a minimum of 98 percent calcium fluoride and a maximum of 1 percent each of silica and calcium carbonate, but a base analysis of 97½ percent calcium fluoride and 1½ percent silica was established by the Office of Price Administration on July 1, 1943. The specifications for ceramic-grade fluorspar vary widely, but the standard specification is a minimum of 95 percent calcium fluoride and a maximum of 2½ percent silica.

CONSUMPTION AND CONSUMERS' STOCKS

The following tables give data on consumption and consumers' stocks of fluorspar.

Fluorspar (domestic and foreign) consumed and in stock in the United States, 1942–43, by industries, in short tons

Industry	1942			1943		
	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31
Basic open-hearth steel	217,100	63,400	4,084	205,676	61,195	3,008
Electric-furnace steel	25,300			28,236		
Bessemer steel	200			236		
Iron foundry	3,600	1,100	57	3,378	1,155	104
Ferro-alloys	4,200	1,000		3,882	2,331	
Hydrofluoric acid	81,600	19,000	585	113,614	27,951	1,443
Primary aluminum	2,000	1,100	49	2,758	1,008	55
Primary magnesium	700	400		3,025	1,026	158
Glass	18,500	7,200	596	20,592	6,184	283
Enamel	3,100	1,100	57	1,726	1,065	132
Welding rod	1,300	200	5	2,286	150	
Cement	400	200	49	262	1,046	
Miscellaneous	2,800	1,300	118	3,214	2,822	348
	360,800	96,000	5,600	388,885	105,933	5,531

Consumption and stocks of fluorspar (domestic and foreign) at basic open-hearth steel plants, 1939–43

	1939	1940	1941	1942	1943
Production of basic open-hearth steel ingots and castings……long tons	43,368,000	55,038,000	66,056,000	67,821,000	69,695,000
Consumption of fluorspar in basic open-hearth steel production……short tons	116,200	143,800	191,300	217,100	205,676
Consumption of fluorspar per ton of steel made……pounds	5.4	5.2	5.8	6.4	5.9
Stocks of fluorspar on hand at steel plants at end of year……short tons	69,900	79,800	84,200	60,400	57,200

The quantity of fluorspar used per long ton of basic open-hearth steel varies with each plant, each operator, each furnace, and each heat but probably ranges from less than 1 pound to 80 pounds. The average for all plants is generally 5 to 8 pounds—a relatively small proportion of the furnace charge. From 1921 (the first year for which these data were collected) to 1940 the average consumption of fluorspar per long ton of steel made declined almost steadily from 8.2 to 5.2 pounds; it increased to 5.8 pounds in 1941 and further to 6.4 pounds in 1942—the highest since 1935. However, it declined to 5.9 pounds in 1943. The decreased consumption in 1943 was due chiefly to conservation measures, rather than to the use of substitutes. Although basic electric steel plants are small users of fluorspar as compared with basic open-hearth steel plants, the average consumption of fluorspar (12.8 pounds in 1943) per long ton of basic electric steel made is substantially greater. However, as in basic open-hearth, the average consumption of fluorspar per ton of basic electric steel made also declined in 1943.

Fluorspar was reported consumed in 37 States and the District of Columbia in 1943, but three States—Illinois, Ohio, and Pennsylvania—used 241,683 tons or 62 percent of the total consumption. In addition to being the chief fluorspar-producing State, Illinois was also the largest consuming State in 1943, taking 87,702 tons or 23 percent of the total. Although ranking third as a consumer of fluorspar in steel, Illinois was the largest consumer of fluorspar in hydrofluoric acid in 1943. Pennsylvania, the second largest consumer in 1943, ranked first in consumption in both steel and glass.

The next table shows, so far as possible without revealing the figures of individual companies, the consumption of fluorspar by States and by consuming industries.

Fluorspar (domestic and foreign) consumed in the United States in 1943, by States and industries, in short tons

State	Steel	Iron foundry and ferro-alloys	Non-ferrous metals	Glass and enamel	Hydro-fluoric acid	Other	Total
Alabama	13,011	13	508				13,532
Georgia							
Arkansas			(1)				(1)
California	6,122	(1)	1,322	(1)	(1)	23	9,855
Oregon							
Washington		(1)				81	
Colorado	15,119						17,765
Iowa		(1)					
Missouri		(1)	(1)	1,110			
Oklahoma							
Texas			(1)		(1)		
Connecticut	2,159	63	(1)	(1)		(1)	2,450
Massachusetts			(1)	(1)			
Rhode Island							
Delaware	1,323				(1)		26,454
District of Columbia							
New Jersey			(1)	(1)	(1)	(1)	
Illinois	22,291	397	142	3,409	(1)	(1)	87,702
Indiana	17,534	600	164				20,287
Kansas			(1)			(1)	(1)
Louisiana			(1)				(1)
Kentucky	13,831			1,855			16,992
Maryland		(1)	(1)			(1)	
West Virginia			(1)			(1)	
Michigan	16,727	771	(1)	(1)		(1)	19,383
Minnesota							
Wisconsin		(1)		119		(1)	
Mississippi				(1)			(1)
Nebraska			(1)				(1)
Nevada			(1)				(1)
New York	13,005	(1)	930	740		(1)	17,749
North Carolina			(1)			(1)	(1)
Ohio	52,831	1,824	828	12,312	(1)	(1)	68,610
Pennsylvania	59,755						85,371
South Dakota						(1)	(1)
Tennessee	440	(1)	(1)	(1)			1,175
Virginia						(1)	311
Wyoming						(1)	(1)
Undistributed [2]		3,592	4,476	2,773	113,614	3,071	1,249
	234,148	7,260	8,370	22,318	113,614	3,175	388,885

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[1] Included under "Undistributed."

[2] Includes entries indicated by "(1)" above.

PRICES

The increased maximum prices for metallurgical-grade fluorspar, which became effective November 23, 1942, and ranged from $25 to $28 a short ton according to calcium fluoride and silica content, did not stimulate production as anticipated. Consequently, effective July 1, 1943, new base prices of $30 to $33 a ton for metallurgical-grade fluorspar were established by the Office of Price Administration in Revised Maximum Price Regulation 126 (Fluorspar), issued July 1, 1943. However, beginning August 30, 1943, the War Production Board controlled deliveries of the higher grade of metallurgical fluorspar. The new regulation also advanced the base prices of acid and ceramic grades of fluorspar to $37 a short ton.

STOCKS AT MINES OR SHIPPING POINTS

According to reports of producers, the quantity of fluorspar in stock at mines or shipping points at the close of 1943 totaled 115,937 tons or 125 percent more than in 1942. These stocks comprised 19,026 tons of finished fluorspar and 96,911 tons of crude fluorspar (calculated to be equivalent to 42,000 tons of finished fluorspar).

Stocks of fluorspar at mines or shipping points in the United States, December 31, 1942 and 1943, by States, in short tons

State	1942			1943		
	Crude[1]	Finished	Total	Crude[1]	Finished	Total
Arizona	30		30			
California	150		150	150	7	157
Colorado	3,601	1,067	4,668	39,108	892	40,000
Idaho				50		50
Illinois	10,521	13,984	24,505	34,079	6,363	40,442
Kentucky	1,774	3,970	5,744	6,541	10,498	17,039
Nevada					200	200
New Mexico	15,605	312	15,917	16,983	573	17,556
Texas					293	293
Utah	500	96	596		200	200
	32,181	19,429	51,610	96,911	19,026	115,937

[1] The greater part of this crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.

TECHNOLOGIC DEVELOPMENTS

Laboratory tests of the Heavy-Media Process for the milling of fluorspar ores having proved encouraging, mills employing this process were installed in 1943 by three companies—Rosiclare Lead & Fluorspar Mining Co. at Rosiclare, Ill., Western Fluorspar Corporation at Northgate, Colo., and Metals Reserve Co. at Gila, N. Mex. The mills of the Western Fluorspar Corporation and Metals Reserve Co. began operating in December 1943. The mill of the Rosiclare Lead & Fluorspar Mining Co. began operating in March 1944, and according to A. H. Cronk, superintendent, "The results are very encouraging and are somewhat better than the laboratory results as determined by the American Cyanamid Co." A fourth company has a Heavy-Media Process mill under consideration. This method of milling is reported to be very satisfactory for free-milling ore and to be more efficient than jigging. Ferrosilicon is used for the heavy medium.

A flotation plant was completed by the Zuñi Milling Co. at Los Lunas, N. Mex., in 1943, and plants are under construction near Cave in Rock, Ill., by the Minerva Oil Co.; near Marion, Ky., by the Corod Minerals Corporation; at Albuquerque, N. Mex., by the American Fluorspar Co.; near Salida, Colo., by the Chaffee County Fluorspar Corporation; and near Forney, Idaho, by A. E. Chambers. The flotation mill of Indian Metals Co. at Lordsburg, N. Mex., which was destroyed by fire, was rebuilt during 1943. Output of flotation concentrates again gained phenomenally, totaling 159,758 short tons in 1943 compared with 106,974 tons in 1942 and 64,627 tons in 1941.

FLUORSPAR INDUSTRY IN 1943, BY STATES

Arizona.—Production in Arizona in 1943, totaling 1,328 short tons of finished fluorspar, came from mines and prospects in Greenlee, Maricopa, and Yuma Counties; most of that from Greenlee County was shipped to flotation plants at Deming and Lordsburg, N. Mex. The flotation concentrates recovered from the fluorspar, rather than the run-of-mine material, have been credited in the statistics to Arizona. The fluorspar from Yuma County was shipped to steel plants in California. The fluorspar from Maricopa County came from the Big Spar, Contact, and Good Luck mines near Wickenburg and was also shipped to steel plants.

California.—Production of fluorspar in California in 1943 was 141 short tons, of which 134 tons were shipped to steel plants. It was produced at the Red Bluff mine near Midland, Riverside County, by E. T. Hermann.

Some Nevada fluorspar was ground at the plant of the Industrial Minerals & Chemical Co. at West Berkeley and shipped to nonferrous smelters and magnesium-reduction plants in 1943. The ground fluorspar is credited in the statistics to Nevada.

Colorado.—Greatly accelerated production at mines in Boulder and Chaffee Counties is indicated by the shipment of 49,145 short tons of fluorspar from Colorado in 1943 compared with 31,743 tons in 1942. Shipments in 1943 established a new record for Colorado and exceeded the previous record made in 1918 by 28 percent; they comprised 22,778 tons of fluxing gravel and foundry lump fluorspar, 25,946 tons of flotation concentrates, and 421 tons of ground fluorspar. Seventy-seven percent went to steel and hydrofluoric-acid plants but some to iron foundries and nonferrous smelters and to glass, enamel, ferro-alloy, cement, and magnesium-reduction plants. A small tonnage of fluxing gravel was shipped to the Government stock pile at Chicago.

Production of finished fluorspar in Colorado totaled 49,000 tons in 1943. In addition, 35,500 tons of crude ore, equivalent to 11,500 tons of finished fluorspar, were mined but not milled in 1943. Thus, total production (expressed in terms of finished fluorspar) was 60,500 tons in 1943. Output came from Boulder, Chaffee, Jackson, Jefferson, Mineral, and Park Counties, but mines in Boulder, Chaffee, and Jackson Counties supplied 90 percent of the State total.

During 1943 Harry M. Williamson & Son added jigs and tables to their flotation mill in Boulder County to make possible the production of both fluxing gravel and flotation concentrates. Production of finished fluorspar was about 5 percent less than in 1942 and comprised 51 percent fluxing gravel and 49 percent acid-grade flotation concentrates. The ore treated in the mill came from the company-operated Argo, Brown Spar, and Emmett mines in Boulder County. Some milling ore was sold to the nearby flotation mill of the General Chemical Co. The shaft at the Emmett mine was sunk an additional 200 feet to a depth of 475 feet. At the Argo shaft a new hoist house, a head frame, and an ore bin were erected, a drift was driven on the winze level to a point under the shaft, and a raise was driven to the bottom of the old shaft.

Production of flotation concentrates at the mill (near Jamestown) of General Chemical Co. about tripled that in 1942. The output of the mill was shipped to the hydrofluoric-acid plants of the company. The flotation-mill feed comprised ore from the company-operated Alice, Burlington, Chancellor, and Yellow Girl mines in Boulder County and some purchased ore. This company also operates a flotation mill in New Mexico.

The Colorado Fluorspar Corporation, which operates a combination flotation-jig mill and a mine near Salida, Chaffee County, produced about 67 percent more finished fluorspar than in 1942. Production in 1943 comprised 61 percent fluxing gravel and foundry lump and 39 percent flotation concentrates. Development consisted of about 1,200 feet of drifting, which resulted in opening additional ore reserves.

During 1943 the Chaffee County Fluorspar Corporation, with a property near Salida, produced and sold some crude ore to a local mill, did considerable development, and in the fall began to construct a flotation mill.

The flotation mill of Kramer Mines, Inc., near Salida, which started operating in October 1942, made a substantial output of concentrates in 1943. The mill feed comprised chiefly ore from the company mines near Salida and Poncha Springs, Chaffee County, and Northgate, Jackson County; some purchased ore mainly from the Chaffee County was also milled. The company did considerable development at its claims in Jackson County. Fleming[4] has described the Chaffee County mines and mill of the Kramer Mines, Inc.

The Western Feldspar Milling Co., Denver, ground 421 short tons of fluorspar, which was shipped to glass plants in 1943. The ore was supplied by the American Fluorspar Corporation. The Western Feldspar Milling Co. discontinued grinding fluorspar in July 1943.

The American Fluorspar Corporation, operating mines near Salida and Poncha Springs (Chaffee County), produced 9 percent more finished fluorspar than in 1942, but its output of milling ore almost tripled the 1942 figure. The flotation mill of the Fluorspar Processing Co.—on property of the American Fluorspar Corporation, which supplies its milling ore—produced 103 percent more fluorspar concentrates than in 1942. Reconditioned flotation cells, a drier, and pumps were installed in the mill, and new loading bins and an elevator to loading bins were constructed. Other improvements included concrete floors throughout the mill and a boiler to provide hot water.

The Western Fluorspar Corporation mill near Northgate, Jackson County, which was destroyed by fire on December 10, 1942, was rebuilt during 1943 and began operating in December. The mill uses the Heavy-Media Process for separating fluorspar from gangue material, with ferrosilicon as the heavy medium. During the building of the mill the company mined a substantial tonnage of ore, some of which was hand-sorted and shipped.

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[4] Fleming, Roscoe, Fluorspar Helps Wage War: Compressed Air Mag., vol. 48, No. 10, October 1943, pp. 7160-7163.

The Wagon Wheel Gap mine of the Colorado Fuel & Iron Corporation was operated 10 months in 1943 as compared with 11 months in 1942; production therefore declined slightly.

Small quantities of fluorspar, which were shipped to steel mills, were produced at the Augusta mine in Jefferson County and the Lake George and Bear Cat mines in Park County.

Idaho.—The Chamac mine near Forney, Lemhi County, was being developed during 1943 by A. E. Chambers, who since October has been constructing a 70-ton flotation mill.

Anderson [5] has described the fluorspar deposits near Meyers Cove, Lemhi County.

Illinois.—Production of finished fluorspar in Illinois was 191,000 short tons in 1943; about 94 percent came from Hardin County and 6 percent from Pope County. In addition, 24,000 tons of crude ore, equivalent to about 13,000 tons of finished fluorspar, were mined but not milled. Thus, total production in 1943 (expressed in terms of finished fluorspar) was 204,000 tons. Considerable Kentucky fluorspar is milled in Illinois, and some Illinois fluorspar is milled in Kentucky; the finished fluorspar so recovered, as well as that shipped, is credited in the statistics to the State of origin. The Argo, Austin, Blue Diggings, Crystal, Daisy-North Daisy, A. L. Davis, Deardorff, Dimick, Douglas, Fairview, Good Hope, West Green, Hillside, Lead Hill, Midway-North Boundary-Air Shaft, Roberts, Rosiclare, Stewart, and Victory properties supplied about 85 percent of the fluorspar produced in Illinois in 1943; the remainder came from many mines and prospects, including the Cave in Rock, Eureka No. 4 and No. 5, East Green, Hawkins Shaft, J. W. Hill, Last Chance, Lost 40, Rock Candy Mountain, Rose Creek, South Boundary-Deep Shaft, and Wall.

Shipments of fluorspar from Illinois (198,789 tons) constituted 49 percent of the total shipped in 1943 and established a new record—23 percent greater than in 1942, the previous record year. The 1943 shipments comprised 89,789 tons to steel plants, 89,599 tons to hydrofluoric-acid plants, 6,741 tons to glass and enamel plants, 2,333 tons to Algeria, Canada, and Peru, and 10,327 tons to iron foundries, nonferrous smelters, aluminum- and magnesium-reduction plants, and ferro-alloy, nickel, and welding-rod manufacturers. Of the 1943 total, 36,643 tons were shipped by river or river-rail to consumers compared with 42,250 tons in 1942.

The Fluorspar Products Co. operated the Lead Hill and Stewart mines and milled purchased ore from various properties. Shipments were 38 percent more than in 1942.

The Aluminum Ore Co., the largest producer of fluorspar in the United States in 1943, produced 58 percent more fluorspar at its flotation plant than in 1942. The mill feed comprised ore from the company-operated Argo, Blue Diggings, Fairview, Good Hope, Hamp and Last Chance mines and some purchased ore, chiefly from the Rose Creek and Rock Candy Mountain mines. The new 700-foot shaft at the Fairview mine, on the Argo-Blue Diggings veins, was completed and put into operation in June 1943. Underground development was carried forward on the Argo vein on various levels operating through the Blue Diggings shaft. Development was continued on the various levels from the Blue Diggings and the Fairview shafts. Additional boiler and generating capacity was installed to take care of the electrically operated Fairview mine.

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[5] Anderson, A. L., The Antimony and Fluorspar Deposits near Meyers Cove, Lemhi County, Idaho. Idaho Bureau of Mines and Geol., Pamph. 62, March 1943, 22 pp.

In 1943, as in 1942, considerable output was lost at the Crystal mine of the Crystal Fluorspar Co. because of two strikes. Production was about the same in both years. An unknown ore body below the creek bed was found by drilling, and a shaft was being sunk on this ore body. The company did 20,500 feet of churn and diamond drilling in 1943.

Production of gravel fluorspar and flotation concentrates by Hillside Fluor Spar Mines was 12 and 15 percent, respectively, less than in 1942. The mill feed comprised ore from the Dimick, Hillside, and Wall mines at Rosiclare, Ill., the Keystone mine near Marion, Ky., and tailings from previous milling operations. Production and shipments of finished fluorspar from the Keystone mine have been credited in the statistics to Kentucky. The Hillside Fluor Spar Mines were acquired on June 1, 1943, by the Inland Steel Co., which will operate the property as a separate unit and continue to serve other consumers.

The Victory mine of the Victory Fluorspar Mining Co. produced 14 percent less fluorspar than in 1942.

Most of the output from the mine of the General Finance Corporation was sold to local mills. However, some of the ore was milled by the company, and the fluxing-gravel fluorspar produced was shipped to steel plants.

The flotation mill of the Mahoning Mining Co. produced 12 percent more fluorspar concentrates than in 1942. The mill feed comprised ore from the A. L. Davis, Deardorff, East Green, and West Green mines and some purchased ore. Production of finished fluorspar comprised 76.5 percent acid-grade and 23.5 percent pelletized gravel. Shaft sinking and underground development were completed at the East Green mine, which began producing in 1943. The flotation-mill expansion program was completed during 1943.

James W. Patton & Sons again treated tailings from the Crystal mine in its flotation mill and also treated some tailings from the C. R. Babb mine for Roberts & Frazer.

The Yingling Mining Co. operated the Rose Creek mine, and the output was sold to a local mill for treatment; however, the company also purchased and milled ore from the Douglas mine, which it acquired in December.

The Minerva Oil Co. continued development at its mine near Cave in Rock and was constructing a flotation mill near the mine. Both units were expected to get into production during March 1944.

The Rosiclare Lead & Fluorspar Mining Co. operated the Daisy-North Daisy, Eureka No. 4 and No. 5, Hawkins Shaft, Midway-North Boundary-Air Shaft, Rosiclare, and South Boundary-Deep Shaft in 1943, but the Rosiclare mine was the chief producer. Production at the gravity-concentration mill and flotation mill was 21 and 8 percent greater than in 1942. Shipments of fluorspar of all grades were 22 percent greater than in 1942. A Heavy-Media Process mill for separating fluorspar from gangue material was nearing completion at the close of 1943. The separating cone is 14 feet in diameter, and ferrosilicon is to be used for the heavy medium. The ore treated will be plus 10-mesh to 1 inch. The minus 10-mesh ore will be flotation-mill feed. The Heavy-Media mill will eliminate the use of jigs. Three diamond drills were operated to find additional ore bodies and new veins; some of the results were satisfactory. The Hawkins, a new mine about 1 mile north of the Rosiclare vein, was opened, and mining in good ore was in progress at the 100-foot level. A submersible pump having a capacity of 1,800 gallons a minute at 650-foot head and equipped with a 350-horsepower motor was installed in the Rosiclare mine in 1943 for pumping protection. This gives a pumping capacity of 8,800 gallons a minute, or about double the inflow of water. A 500-kilowatt turbine generator was added to the power plant.

Production at the Roberts mine in Pope County, operated by Roberts & Frazer of Illinois (Kentucky Fluor Spar Co. affiliate), was substantially greater than in 1942. The known ore in this mine was exhausted in November 1943.

The Rock Candy Mountain mine, also in Pope County, operated by the Big Creek Mining Co., produced considerable crude ore, which was sold to local mills.

Kentucky.—Production of finished fluorspar in Kentucky was 116,500 short tons in 1943. In addition, 5,000 tons of crude ore, equivalent to 2,500 tons of finished fluorspar, were mined but not milled. Thus, production (expressed in terms of finished fluorspar) totaled 119,000 tons in 1943. Shipments again declined and amounted to 109,849 tons—a decrease of 18 percent from 1942 and 23 percent less than the all-time record for 1941. The 1943 shipments comprised 89,419 tons to steel plants, 10,153 tons to glass and enamel plants, 1,739 tons to hydrofluoric-acid plants, 1,889 tons to Canada, and 6,649 tons to iron foundries, nonferrous smelters, and cement, ferro-alloy, aluminum-reduction, and miscellaneous plants. Of the 1943 total, 15,270 tons were shipped to consumers by river or river-rail compared with 36,799 tons in 1942.

Output in Caldwell County came chiefly from the Crook, Glass, Hollowell & Hobby, Hughett, Perkins, and Senator mines, most of it being from the Hollowell & Hobby, Hughett, and Senator mines.

Output at the mine of Hughett Mining Co. near Princeton about doubled that of 1942.

The New York & Kentucky Mining Co., operating the Hollowell & Hobby mine near Princeton, produced 12 percent more fluorspar than in 1942.

The Midland Minerals Corporation, which was organized late in 1942, commenced operations at the Senator mine near Princeton in January 1943 and produced a substantial tonnage of fluxing-gravel fluorspar during the year.

The major part of the output in Crittenden County came from a few mines—Bachelor, Davenport, Keystone, Pigmy, Tabb, and Watson (Eagle). Most of the remainder came from many smaller mines (including the Babb, Barnes, Blue, Columbia, Gilless, Guill, Hodge, Krause, La Rue, Marion Lake, Summers, and Watkins) and from numerous prospects; some was reclaimed from waste dumps and old workings of abandoned mines.

The Eagle Fluorspar Co. worked the Adams, Babb, Guill, and Watson (Eagle) mines and produced 33 percent less finished fluorspar than in 1942. The Babb mine was under development in 1943. Perry and Loyd reworked the Watson tailings and recovered considerable fluorspar.

Operations at the Summers mine and mill of R. J. Forester were suspended in July 1943; consequently, production was substantially less than in 1942.

The Tabb mines and mill of the United States Coal & Coke Co. produced 14 percent less finished fluorspar than in 1942, but shipments declined 47 percent. The company did considerable development in 1943.

The Kentucky Fluor Spar Co. and affiliates did the largest volume of business in its history; tonnage and dollar sales were 8 and 16 percent, respectively, greater than in 1942, the previous record year. The company operates a mill near Marion, and through its mining divisions (Roberts & Frazer and Hettiger & Frazer), operated the C. R. Babb, Carr, Ellis, and Wright mines in Livingston County, the Pepper Box mine in Crittenden County, and the Roberts mine in Pope County, Ill., in 1943. About three-fourths of the company supply came from these mines, and the remainder chiefly from the Barnes, Blue, Hollowell & Hobby, and Nancy Hanks.

Production at the Keystone mine of Hillside Fluor Spar Mines was substantially less than in 1942. Although the fluorspar from this mine is finished at the company mill at Rosiclare, Ill., production and shipments are credited in the statistics to Kentucky.

At the Pigmy mine of the Pigmy Corporation (subsidiary of the Rosiclare Lead & Fluorspar Mining Co.) production was 11 percent less than in 1942. A newly located ore body was developed further by extension of the 100-foot level, and the results were very encouraging. A diamond drill was operated on the Pigmy property during 1943, and the results indicated further downward extension of the ore body on the west side of the property.

During 1943 the National Fluorspar Co. sank a 300-foot shaft on a newly discovered ore body in its Davenport mine. A new 7-inch Pomona pump and a 66-horsepower Diesel engine will be installed in 1944. The power plant was being moved to the new location. The lower working levels of the old shaft were flooded from March to July; meanwhile, production was confined to a small tonnage of low-grade ore from the upper levels and to the re-treatment of about 1,000 tons of tailings. Consequently, production of finished fluorspar was 22 percent less than in 1942.

Output at the Bachelor mine of the Delhi Fluorspar Corporation was at a greatly reduced rate in 1943. However, the company purchased both finished fluorspar and milling ore from many producers, and consequently its shipments were much greater than in 1942.

Shipments of fluorspar by L. Conyer, operating a mill near Marion, were two and one-half times those of 1942. Conyer does not operate any mines but purchases milling ore from various mines. The bulk of the ore milled in 1943 was supplied by the Hughett Mining Co. and Craighead Bros.

The Corod Minerals Corporation was constructing a flotation mill near Marion in 1943. It mined a small quantity of ore at the Columbia mine.

In Livingston County most of the fluorspar output came from the C. R. Babb, Carr, Junior, Nancy Hanks, and Wright mines, from

C. R. Babb and Nancy Hanks tailings, and from the reclaiming plant working Klondike tailings.

Output at the C. R. Babb, Carr, Ellis, and Wright mines of Roberts & Frazer was slightly greater than in 1942. E. W. Frazer reworked the tailings at the C. R. Babb mine and recovered 1,130 tons of fluorspar. Some tailings from the C. R. Babb mine were treated at the Patton flotation mill in Illinois and 186 tons of acid-grade concentrates were recovered.

Production at the Nancy Hanks mine, operated by W. V. Haynes, Jr., was retarded somewhat because of development during 1943, and output of finished fluorspar was slightly less than in 1942. Tinsley & Loyd reclaimed a substantial tonnage of fluorspar from Nancy Hanks tailings.

Butler & Moodie, operating the Junior mine and reclaiming fluorspar from the Klondike-mine tailings, recovered 29 percent more fluorspar than in 1942.

In the Central Kentucky district production of fluorspar increased to 2,469 short tons in 1943 (79 tons in 1942). Output in this district came from the Faircloth mine in Woodford County, near Wilmore, operated by Ralph E. Jones; the Lone Oak mine near Harrodsburg in Mercer County, operated by the Lone Oak Ore Co.; and a property near Talmage, also in Mercer County, operated by Mercer Minerals, Inc. The Twin Chimney mine near Mundys Landing in Mercer County was acquired by the Lone Oak Ore Co. and began producing fluorspar in January 1944. The Faircloth mine was equipped with an electrically operated hoist and a pump in 1943. A new ore body was found one-fourth mile from the Faircloth mine. The shaft at the mine of Mercer Minerals, Inc., was sunk 125 feet.

Nevada.—Shipments of fluorspar from Nevada in 1943 (8,653 short tons) were 8 percent greater than in 1942 but 4 percent under the all-time record of 1941. Most of the 1943 total went to steel plants, but some was shipped to hydrofluoric-acid, ferro-alloy, and cement plants and to nonferrous smelters.

The chief producing mine in Nevada in 1943 was the Baxter in Mineral County, operated by V. S. Baxter. Production was 10 percent more than in 1942. The other chief producing mine was the Daisy in Nye County, operated by J. Irving Crowell, Jr.; production was also 10 percent greater than in 1942. A carload of fluorspar was produced and shipped from the Cirac mine in Churchill County, operated by E. S. Perry and associates.

New Mexico.—Production of finished fluorspar in New Mexico totaled 37,300 short tons in 1943. In addition, 1,400 tons of crude ore, equivalent to 400 tons of finished fluorspar, were mined but not milled in 1943. Thus, total production (expressed in terms of finished fluorspar) was 37,700 tons in 1943. The output came chiefly from Grant, Luna, Sierra, and Valencia Counties.

Shipments from New Mexico totaled 37,050 short tons, a gain of 64 percent over the all-time high of 1942. Most of the 1943 shipments were flotation concentrates, which moved chiefly to hydrofluoric-acid plants, but some was shipped to steel, glass, enamel, ferro-alloy, and magnesium-reduction plants and to the Government stock pile at East St. Louis, Ill. Most of the metallurgical-grade fluorspar went to steel plants and iron foundries, but some was shipped to the Government stock pile at Chicago.

The flotation mill of the General Chemical Co. at Deming was operated at about the same rate as in 1942. The mill feed comprised ore from the company Spar Group and Sadler mines in Luna County and the Osmer mine in Grant County, and considerable purchased ore from local mines. Virtually all the flotation concentrates produced were shipped to the hydrofluoric-acid plants of the company.

The flotation plant of the Zuñi Milling Co. at Los Lunas made its initial production in March 1943 and was the largest producer of fluorspar in New Mexico in 1943. Most of the concentrates were shipped to hydrofluoric-acid plants, but some were shipped to the Government stock pile at East St. Louis, Ill., and to glass plants. The mill feed is supplied by the Navajo mine in Valencia County. In addition to supplying milling ore to the flotation plant, the Navajo mine shipped 7,700 tons of fluxing-gravel fluorspar. The Navajo mine was acquired during the latter part of 1943 by the Shattuck Denn Mining Corporation, which has also taken over management of the flotation plant at Los Lunas.

The flotation mill of the Indian Metals Co. at Lordsburg was destroyed by fire on March 28, 1943; it was rebuilt and began operating again in July. Consequently, production was substantially less than in 1942. The mill feed is supplied by various mines and prospects in Arizona and New Mexico. The 1943 shipments went to steel, hydrofluoric-acid, and magnesium-reduction plants.

Production of flotation concentrates at the mill of P. L. Grattan at Deming was 66 percent greater than in 1942. The mill feed was supplied by the company mine and by purchased ore. The 1943 shipments moved to hydrofluoric-acid, steel, enamel, and magnesium-reduction plants.

J. K. Stanland continued development at the Blue Diamond mine in Dona Ana County, in the course of which some milling ore was produced and shipped to a local flotation plant. The gravity-concentration mill under construction was not completed in 1943.

A mill for producing fluxing-gravel fluorspar was completed and put into operation at Gila on December 27, 1943. The mill is owned by the Metals Reserve Co. and will be operated for it by the International Minerals & Chemical Co. to mill ore purchased from surrounding mines. Concentration is by the Heavy-Media Process, using ferrosilicon as the heavy medium. Pending completion of the mill a substantial tonnage of ore was accumulated at the mill; most of it was supplied by Brown & Johnson Corporation, chiefly from the Clum mine near Gila, and by McCray & Penn from the Burro Chief mine near Tyrone.

The Lyda K mine in Sierra County, owned by Kinetic Chemicals, Inc. (du Pont subsidiary), was put in operation in the early part of 1943 to produce a small quantity of metallurgical fluorspar and at the same time to carry on further exploration and development. The ore was found to be difficult to convert to metallurgical grade by simple hand sorting; after 201 tons were produced and shipped, production was discontinued, but development was continued the remainder of the year. The middle or No. 2 shaft was being deepened to explore on the 220-foot level a section of the ground that had not been explored earlier when diamond drilling was conducted in the south half of the ore body. Deepening of the shaft was expected to be completed in early 1944, after which drifting along the vein will be conducted.

In June 1943 J. K. Stanland acquired the Bonita mine, where he did considerable development, in the course of which some ore was taken out and milled at the plant of Both Mining & Milling Co. This mine was acquired on December 9 by the Bonita Trust, which continued development and produced a small quantity of metallurgical-grade fluorspar.

During the first half of 1943 Both Mining & Milling Co. produced a small tonnage of fluxing-gravel fluorspar at the Bonita mine in Valencia County. The company did custom milling for others at its concentrating plant at Grants.

Development was in progress during 1943 at the Blackbird prospect near Albuquerque in Bernalillo County by the American Fluorspar Co. A jig mill was constructed but proved unsatisfactory. Subsequently, a flotation mill was purchased and was being installed at Albuquerque. It was expected to be completed in March 1944.

Tennessee.—A small quantity of ore mined at a property presumably in Smith County near Rome was trucked to Marion, Ky., where it was finished in the mill of Delhi Fluorspar Corporation.

Texas.—Previous commercial production of fluorspar in Texas has consisted of small amounts of milling ore, which were shipped to a flotation plant at Deming, N. Mex. In 1943, however, production amounted to 1,253 tons, of which 960 tons were shipped to steel plants. Production came from the Glass & O'Brien mine in Burnet County and the Eagle Springs, Fenley, and Eagle Mountains mines in Hudspeth County. Operations at the Glass & O'Brien and Eagle Springs mines were discontinued during 1943. At the Eagle Mountains mine, operated by the Texas Fluorite Co., a concentrating mill was under construction. The fluorspar deposits of Hudspeth County have been described by Evans[6] and those of Burnet County by Barnes.[7]

Utah.—Only 1 car (51 tons) of fluorspar was shipped from Utah in 1943 compared with 1,018 tons (an all-time high) in 1942. It was shipped by the Western Fluorite Co., which also did development at its properties in Beaver County. Fred Staats, operating the Staats mine, also in Beaver County, produced a small quantity of fluorspar in 1943 but made no shipments. The Tintic Standard Mining Co. continued development work at the Cougar mine near Milford in Beaver County, where a concentrating mill was nearing completion at the end of 1943.

FOREIGN TRADE

Imports.—Imports of fluorspar for consumption in the United States in 1943 were the largest since 1930 and reached 43,570 short tons (1,854 tons containing more than 97 percent calcium fluoride and 41,716 tons containing not more than 97 percent calcium fluoride), valued[8] at $643,409, compared with 2,151 tons (1,882 tons containing more than and 269 tons containing less than 97 percent calcium fluoride), valued[8] at $35,529 in 1942. The value assigned to the higher-grade foreign fluorspar averaged $16.98 and $22.46, respectively, in 1942 and 1943, and that of the lower-grade $13.30 and $14.43, respectively. The cost to consumers in the United States also includes duty, loading charges, insurance, consular fee, and freight to consuming plants. The duty on fluorspar containing not more than 97 percent calcium fluoride is $5.625 a short ton and on fluorspar containing more than 97 percent calcium fluoride, $3.75 a short ton.

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[6] Evans, G. L., Fluorspar Deposits in the Eagle Mountains of Hudspeth County, Tex.: Bureau of Econ Geol., Univ. of Texas, Min. Resource Circ. 26, June 21, 1943, 13 pp.

[7] Barnes, V. E., Preliminary Reconnaissance Report on Fluorite in the Spring Creek Area of Burnet County, Tex.: Bureau of Econ. Geol., Univ. of Texas, Min. Resource Circ. 27, May 31, 1943, 6 pp.

[8] As defined in sec. 402 of the tariff act of 1930, "The value of imported merchandise * * * is the foreign value or the export value, whichever is higher—that is, the market value or the price at which the merchandise, at the time of exportation to the United States, is offered for sale in the principal markets of the country from which exported, including the cost of containers or coverings and all expenses (including any export tax) incident to placing the merchandise in condition ready for shipment to the United States."

Fluorspar imported for consumption in the United States in 1943, by countries[1] *and customs districts*

Country and customs district	Containing more than 97 percent calcium fluoride		Containing not more than 97 percent calcium fluoride		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Mexico:						
Buffalo			96	$2,785	96	$2,785
El Paso	773	$10,161	6,112	62,694	6,885	72,855
Laredo	1,081	31,474	12,453	130,290	13,534	161,764
	1,854	41,635	18,661	195,769	20,515	237,404
Newfoundland: Buffalo			7,144	175,829	7,144	175,829
Spain: Philadelphia			15,341	222,676	15,341	222,676
Union of South Africa: New York			570	7,500	570	7,500
Total: 1943	1,854	41,635	41,716	601,774	43,570	643,409
1942	1,882	31,951	269	3,578	2,151	35,529

[1] For historical table, see Minerals Yearbook, 1941, p. 1401.

The following table, compiled from data furnished to the Bureau of Mines by importers, shows the quantities of imported fluorspar delivered to consumers in the United States in 1942 and 1943, irrespective of the year of importation into the United States; it differs from the preceding table, which shows the quantities received in the United States during 1942 and 1943. The quantities in the following table are based upon the actual outturn weights ascertained by sworn weighers and represent the weights on which duty was paid and entries were liquidated.

Imported fluorspar delivered to consumers in the United States, 1942–43, by uses

Use	1942			1943		
	Short tons	Selling price at tidewater, including duty		Short tons	Selling price at tidewater, including duty	
		Total	Average		Total	Average
Steel	269	[1] $6,700	[1] $24.91	15,616	[1] $503,000	[1] $32.21
Hydrofluoric acid	1,900	53,500	28.16	140	3,535	25.25
	2,169	60,200	27.75	15,756	506,535	32.15

[1] Estimated.

Exports.—Producers of fluorspar reported exports of 9,044 short tons of fluorspar valued at $246,973 in 1943 compared with 9,016 tons valued at $242,545 in 1942. The exports by producers in 1943 comprised 1,936 tons of fluxing gravel, 435 tons of ceramic ground, and 6,364 tons of flotation concentrates to Canada, 9 tons of fluxing gravel to Algeria, and 300 tons of flotation concentrates to Peru. In addition to the fluorspar exported by producers in 1943, brokers exported 24 tons—5 to Brazil, 16 to Chile, 1 each to Colombia and Uruguay, and the remainder to Argentina, Cuba, El Salvador, and Mexico.

Fluorspar reported by producers as exported from the United States, 1939-43

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1939	2,976	$74,443	$25.01	1942	9,016	$242,545	$26.90
1940	8,482	178,467	21.04	1943	9,044	246,973	27.31
1941	12,184	277,782	22.80				

WORLD PRODUCTION

The following table shows world production of fluorspar by countries from 1937 to 1943, insofar as statistics are available. Because of restriction on the publication of statistics by the governments of many countries, few figures are available since 1939.

World production of fluorspar, 1937-43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina (shipments)	350	1,406	739	597	2,027	2,350	(2)
Australia:							
New South Wales	55					[3] 914	(2)
Queensland	1,410	2,479	20	888	706		
Victoria		804			132		
Canada	136	197	218	4,041	5,020	5,624	10,965
Chosen	11,000	[4] 34,207	(2)	(2)	(2)	(2)	(2)
France	51,430	51,920	(2)	(2)	(2)	(2)	(2)
Germany:							
Anhalt	13,662	10,462	(2)	(2)	(2)	(2)	(2)
Baden	13,637	21,350	(2)	(2)	(2)	(2)	(2)
Bavaria	62,455	59,919	(2)	(2)	(2)	(2)	(2)
Prussia	30,514	22,956	(2)	(2)	(2)	(2)	(2)
Saxony	8,074	12,063	(2)	(2)	(2)	(2)	(2)
Thuringia	16,117	22,405	(2)	(2)	(2)	(2)	(2)
India, British			20	(2)	(2)	(2)	(2)
Italy	13,385	12,186	(2)	(2)	(2)	(2)	(2)
Mexico (exports)	(2)	(2)		9,271	10,521	5,365	22,269
Newfoundland (shipments)	8,479	8,944	11,227	14,697	11,581	[3] 32,660	66,170
Norway	1,692	1,676	2,367	(2)	(2)	(2)	(2)
Southern Rhodesia		156		(2)	(2)	(2)	(2)
South-West Africa		585	105	(2)	(2)	(2)	(2)
Spain	4,250	8,596	8,408	9,097	15,410	[3] 48,000	(2)
Tunisia	1,676	2,060	2,473	(2)	(2)	(2)	(2)
Union of South Africa	3,615	4,736	10,322	7,421	[3] 3,900	4,185	[5] 2,317
U. S. S. R	[3] 70,000	(6)	(2)	(2)	(2)	(2)	(2)
United Kingdom	42,837	33,866	[7] 17,521	(2)	(2)	(2)	(2)
United States (shipments)	164,408	72,940	165,806	211,917	290,905	326,871	368,330
	519,000	456,000	(2)	(2)	(2)	(2)	(2)

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[1] In addition to countries listed China produces fluorspar, but data of output are not available.

[2] Data not available.

[3] Estimate.

[4] Exports.

[5] January to September, inclusive.

[6] Estimate included in total.

[7] January to June, inclusive.

Canada.—According to the Dominion Bureau of Mines, production of fluorspar in Canada has been small and intermittent, the total output from 1905 through 1942 being approximately 65,000 short tons, about half of which came from Ontario and the remainder from British Columbia. Although production increased to 12,087 short tons in 1943 (6,199 tons in 1942), output falls far short of consumption and the greater part of the requirements is met by importations from Mexico, Newfoundland, and the United States. Imports were 77,436 tons in 1943 (47,783 tons in 1942). Most of the Canadian output in 1942 and 1943 came from the Madoc area in Ontario, but a little was mined in Nova Scotia. The Dominion Government has furnished financial and other assistance in developing fluorspar deposits and has also set prices for the various grades produced.

Mexico.—Production of fluorspar in Mexico was about 17,300 short tons in 1943 compared with 3,300 tons in 1942. Exports were 24,547 tons in 1943 compared with 5,914 tons in 1942. The Azul mine near Taxco, Guerrero, supplied about 70 percent of the total output in 1943.

Newfoundland.—Production of fluorspar in Newfoundland in 1943 was more than double that of 1942. The fluorspar is produced by the St. Lawrence Corporation of Newfoundland, Ltd., and Newfoundland Fluorspar, Ltd., the latter a subsidiary of the Aluminum Co. of Canada, Ltd. The output of the St. Lawrence Corporation of Newfoundland, Ltd., is shipped to Canada and the United States; and that of Newfoundland Fluorspar, Ltd., is shipped to Arvida, Canada, where the Aluminum Co. of Canada, Ltd., has a flotation plant to mill the ore to acid grade.

The fluorspar deposits of Newfoundland have been described by Van Alstine.[9]

South Africa.—Fluorspar has become increasingly important in South Africa during recent years because of the growth of the steel industry. The fluorspar occurrences in the Union of South Africa and South-West Africa have been described recently.[10]

CRYOLITE

Imports of cryolite were 46,400 long tons valued at $3,117,888 in 1943 compared with 64,565 long tons valued at $3,859,875 in 1942. The cryolite imported in both years came from Greenland.

Cryolite occurs in commercial quantity and is mined at only one place—Ivigtut, Greenland. Gibbs[11] has described the mine at Ivigtut, grades of ore produced, methods of processing and purification, and various uses of cryolite.

Artificial cryolite was manufactured in the United States in 1943 by the Aluminum Ore Co., at East St. Louis, Ill. Production was 27 percent greater in 1943 than in 1942. Plants for the manufacture of artificial cryolite were completed at Bauxite, Ark., by the Aluminum Ore Co., and at Cornwells Heights, Pa., by the Pennsylvania Salt Manufacturing Co., but were not operated in 1943.

The chief use of cryolite is as a flux in the reduction of aluminum; comparatively small amounts are used in glass, enamels, abrasives, and insecticides.

A sizable proportion of the cryolite used in the United States is made from fluorspar. According to Frary:[12]

> The fluorspar is treated with sulfuric acid to produce hydrofluoric acid, and this is neutralized with the proper amounts of soda ash and aluminum hydrate to produce the cryolite, which is a double fluoride of sodium and aluminum (Na_3AlF_6). The artificial cryolite is quite satisfactory and, in fact, considerably lower in objectionable impurities than the natural cryolite usually used. There would be no serious difficulty in getting along with the artificial product if the supply of natural cryolite from Greenland is shut off.

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[9] Van Alstine, R. E., Fluorspar Deposits of St. Lawrence, Newfoundland: Econ. Geol., vol. 39, No. 2, March-April 1944, pp. 109-132.

[10] Kent, L. E., and others, Fluorspar in the Union of South Africa and South-West Africa: Union of South Africa, Dept. of Mines, Geol. Ser., Bull. 14, Pretoria, 1943, 69 pp.

[11] Gibbs, A. E. (technical director, Pennsylvania Salt Manufacturing Co.), Cryolite as a Chemical Raw Material: Chem. Ind., vol. 38, May 1936, pp. 471-476.

[12] Frary, F. C., Cryolite from Fluorspar: Steel, vol. 108, No. 26, June 30, 1941, p. 4.

FELDSPAR

By ROBERT W. METCALF AND A. B. CADE [1]

SUMMARY OUTLINE

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SUMMARY

In spite of severe competition, continued curtailment of pottery and enamel manufacture, and scarcity of labor, sales of domestic crude feldspar in 1943 dropped less than 3 percent in quantity below the 1942 figure but rose 6 percent in value over 1942. Total realization for crude spar was the highest on record—2 percent more than in 1926, the former high year. Sales of ground feldspar advanced 2 percent in quantity and value from 1942; the 1943 tonnage was the second-highest on record, surpassed only by 1941. This active rate of production, however, was maintained only by seriously depleting stocks of crude spar, normally held in reserve, as well as processing currently mined material.

Salient statistics of the feldspar industry in the United States, 1941–43

	1941	1942	1943	Percent of change in 1943
Crude feldspar:				
Domestic sales:				
Long tons	338,860	[1] 316,166	308,180	−2.5
Value	$1,519,456	[1] $1,546,702	$1,646,277	+6.4
Average per long ton	$4.48	[1] $4.89	$5.34	+9.2
Imports:				
Long tons	11,253	9,525	11,912	+25.1
Value	$73,236	$69,797	$100,087	+43.4
Average per long ton	$6.51	$7.33	$8.40	+14.6
Ground feldspar sold by merchant mills:				
Short tons	354,417	327,786	335,810	+2.4
Value	$3,782,603	$3,524,969	$3,591,960	+1.9
Average per short ton	$10.67	$10.75	$10.70	−.5
Imports:				
Short tons	------------	------------	41	------------
Value	------------	------------	$417	------------
Average per short ton	------------	------------	$10.17	------------

[1] Revised figures.

A significant factor in the current activity of the feldspar industry was the increased demand for glass, particularly glass containers, undoubtedly the most important market for feldspar. Production and shipments of glass containers in 1943 increased 17 and 19 percent, respectively, over 1942 figures, while inventories dropped 43 percent during the year. Production of plate glass showed a 20-percent recovery in 1943 compared with 1942. The demand for vitrified porcelain, in the production of which substantial percentages of feldspar are used, was heavy during 1943.

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[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

POST-WAR PROSPECTS

The outlook for feldspar seems rather favorable notwithstanding competing products, such as "aplite" and nepheline syenite. Present shortages of labor, however, due to higher job priorities in other industries and losses of manpower to the armed services, may result in lowered output, at least temporarily. The employment of glass for structural and other purposes and its use in many applications in place of steel, lead, rubber, tin, copper, brass, and plastics may establish permanent markets. To a certain extent, porcelain, another large consumer of feldspar, is now replacing steel, chrome, and other metals. After the war, there probably will be a heavy demand for enameled products, including refrigerators, stoves, other kitchen equipment, and similar articles, the production of which at present is curtailed.

Another favorable factor is the recovery of feldspar by froth flotation. This process has been developed for separation of quartz and feldspar, with encouraging results. Two plants whose primary product is spodumene also have been recovering feldspar by this method, and another plant now is being erected to process feldspar-rich pegmatite. These developments may presage less selective mining methods and more economical recovery of feldspar.

DOMESTIC PRODUCTION

Following the usual practice in the industry, crude feldspar is reported in long tons of 2,240 pounds and ground feldspar in short (net) tons of 2,000 pounds.

Crude feldspar.—Sales of crude feldspar in 1943 showed a decrease of 3 percent in quantity and an increase of 6 percent in value compared with 1942. The total value reported in 1943 established a new record, breaking the former high in 1926 by 2 percent.

Crude feldspar sold or used by producers in the United States, 1939–43

[Value at mine or nearest shipping point]

Year	Long tons	Value		Year	Long tons	Value	
		Total	Average			Total	Average
1939	253, 466	$1, 112, 857	$4. 39	1942	[1] 316, 166	[1] $1, 546, 702	[1] $4. 89
1940	290, 763	1, 271, 995	4. 37	1943	308, 180	1, 646, 277	5. 34
1941	338, 860	1, 519, 456	4. 48				

[1] Revised figures.

Crude feldspar sold or used by producers in the United States, 1941–43, by States

[Value at mine or nearest shipping point]

State	1941		1942		1943	
	Long tons	Value	Long tons	Value	Long tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	4,464	$22,490	5,090	$23,261	(1)	(1)
Colorado	42,326	147,640	33,610	135,569	20,659	$88,691
Connecticut	13,693	92,397	12,807	92,076	11,618	76,463
Maine	22,566	116,610	8,835	53,143	6,748	41,652
Maryland	(1)	(1)				
Massachusetts	(1)	(1)				
New Hampshire	52,219	200,569	46,544	241,990	(1)	(1)
New York	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	100,016	552,386	93,644	533,448	112,144	656,182
Pennsylvania	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	59,015	170,723	[2] 64,842	[2] 225,410	70,913	342,643
Texas	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	(1)	(1)	24,298	140,304	20,550	122,957
Wyoming	11,846	43,484	13,953	50,730	(1)	(1)
Undistributed[3]	32,715	173,157	12,543	50,771	65,548	317,689
	338,860	1,519,456	[2] 316,166	[2] 1,546,702	308,180	1,646,277

[1] Included under "Undistributed."
[2] Revised figures.
[3] Includes States indicated by "(1)."

States producing crude feldspar in 1943 were the same as in 1942. North Carolina produced more feldspar than in any other year in its history; production was 9 percent greater than during the previous record year 1929 and 20 percent higher than in 1942. South Dakota also established a new high in 1943, a 9-percent increase over 1942, the former high year. Output for Wyoming also increased. All other States, both those for which figures can be shown and those for which production may not be published, showed moderate to large percentage decreases. Higher costs and difficulties in procuring and keeping efficient labor, due largely to increased wages in high-priority industries and the demands of selective service, were among the most pressing troubles besetting the feldspar industry in 1943.

The average sales realization per long ton for crude feldspar increased from $4.89 in 1942 to $5.34 in 1943, or 9 percent, the highest realization reported since 1934. All States for which figures can be published except Connecticut show higher average values in 1943 than in 1942. Averages per ton for certain States in both years (1942 in parentheses) follow: North Carolina, $5.85 ($5.70); Virginia, $5.98 ($5.77); Maine, $6.17 ($6.02); Colorado, $4.29 ($4.03).

Ground feldspar.—Sales of ground feldspar by merchant mills in 1943 increased about 2 percent in both quantity and value compared with 1942 and were only 5 percent in quantity under the record year 1941. Tennessee and North Carolina mills combined supplied 30 percent of the total ground spar sold compared with 26 percent in 1942 and 27 percent in 1941 and 1940. As output in South Dakota in 1943 may not be published, the Colorado-South Dakota and North Carolina-Tennessee totals cannot be compared. In 1942, however, the Colorado-South Dakota total was 37 percent of the national total and in 1941, 34 percent. Sales of feldspar of Canadian origin ground in United

States mills totaled only 2 percent of the total merchant sales in 1943, compared with 3 percent in 1942 and 6 percent in 1937. In addition to the tonnage of Canadian origin given in the following table, some feldspar generally is imported direct by consumers, principally cleanser and pottery manufacturers.

Ground feldspar sold by merchant mills [1] in the United States, 1939–43

Year	Active mills	Domestic			Canadian			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
1939	31	249, 889	$2, 685, 473	$10. 75	9, 305	$176, 805	$19. 00	259, 194	$2, 862, 278
1940	29	277, 612	2, 912, 470	10. 49	8, 101	153, 012	18. 89	285, 713	3, 065, 482
1941	29	347, 092	3, 646, 404	10. 51	7, 325	136, 199	18. 59	354, 417	3, 782, 603
1942	29	318, 209	3, 339, 462	10. 49	9, 577	185, 507	19. 37	327, 786	3, 524, 969
1943	27	329, 354	3, 465, 885	10. 52	6, 456	126, 075	19. 53	335, 810	3, 591, 960

[1] Excludes potters or others who grind for consumption in their own plants.

South Dakota in 1943 again ranked first in production of ground feldspar, followed by Tennessee, North Carolina, Colorado, and New Hampshire. Of the States for which figures may be shown, North Carolina-Tennessee reported a 16-percent increase, whereas both Colorado and New Jersey (which includes some spar ground in Connecticut) produced less in 1943. Sales of ground spar in New Hampshire, South Dakota, and Virginia, for which data may not be published, were larger than in 1942. Sales in 1943 in all other States declined.

Ground feldspar sold by merchant mills [1] in the United States, 1941–43, by States

State	1941			1942			1943		
	Active mills	Short tons	Value	Active mills	Short tons	Value	Active mills	Short tons	Value
Arizona	1	(2)	(2)	1	(2)	(2)	1	(2)	(2)
California	3	4, 079	$48, 292	3	5, 578	$72, 924	2	(2)	(2)
Colorado	3	61, 141	387, 338	3	51, 684	349, 065	3	39, 326	$271, 854
Connecticut	1	(3)	(3)	1	(3)	(3)	1	(3)	(3)
Illinois	1	(2)	(2)	1	(2)	(2)	1	(2)	(2)
Maine	3	19, 713	270, 434	3	14, 052	206, 633	2	(2)	(2)
New Hampshire	2	(2)	(2)	2	(2)	(2)	2	(2)	(2)
New Jersey	3	[3] 25, 672	[3] 459, 974	3	[3] 22, 649	[3] 402, 479	3	[3] 20, 780	[3] 365, 483
New York	4	(2)	(2)	4	(2)	(2)	3	(2)	(2)
North Carolina	2	5, 391	1, 179, 577	2	86, 240	1, 037, 998	3	100, 157	1, 181, 600
Tennessee	2			2			2		
South Dakota	2	59, 581	407, 454	2	68, 025	483, 075	2	(2)	(2)
Virginia	2	(2)	(2)	2	(2)	(2)	2	(2)	(2)
Undistributed [4]		88, 840	1, 029, 534		79, 558	972, 795		175, 547	1, 773, 023
	29	354, 417	3, 782, 603	29	327, 786	3, 524, 969	27	335, 810	3, 591, 960

[1] Excludes potters or others who grind for consumption in their own plants.
[2] Included under "Undistributed."
[3] Connecticut included with New Jersey.
[4] Includes items indicated by "(2)."

The average realization per ton for ground feldspar dropped from $10.75 in 1942 to $10.70 in 1943 but it compares favorably with the $10.67 registered in 1941 and $10.73 in 1940. The lower average value in 1943 probably was due in part to larger shipments of glass spar at the expense of the more finely ground pottery and enamel grades. For all States except New Hampshire, New Jersey, and North Carolina, however, the average value of ground spar sold was higher in 1943 than in 1942. The rate of increase in most States was moderate, ranging from 1 percent in New York to about 9 percent in South Dakota. Average values for individual States in 1943 ranged from $6.91 to $17.86, slightly higher figures than for 1942. Average realizations for selected States in 1943 follow: Colorado, $6.91; South Dakota, $7.71; North Carolina-Tennessee, $11.80; and New Jersey (including marketed spar ground in Connecticut), $17.59.

According to E&MJ Metal and Mineral Markets, quoted prices for ground feldspar were the same during 1943 as reported for 1941 and 1942. Potash feldspar, f. o. b. North Carolina, 200-mesh, white, in bulk, was quoted at $17 per short ton, and soda spar, similarly prepared, at $19. Potash and soda spar, f. o. b. Maine, 200-mesh, white, in bulk, were listed at $17 and $19 per ton, respectively. Granular glass feldspar, f. o. b. North Carolina, 20-mesh, white, in bulk, was priced at $12.50 per ton, and semigranular glass spar at $11.75 per ton. Quotations on Virginia feldspar, as listed in the same journal, were: No. 1, 230-mesh, $18; 200-mesh, $17; glassmakers' spar, No. 18, $12.50, and No. 17, $11.75. Ground spar for enamelers' use ranged from $14 to $16 per ton f. o. b., either on a Spruce Pine, N. C., or Keene, N. H., basis.

CONSUMPTION AND USES

Crude feldspar.—Most crude feldspar is sold to merchant mills, which obtain their supply from a number of mines or localities. The raw spar is stock-piled and sorted according to grade and source, then blended and ground to specified purity and fineness and sold to ultimate consumers. However, a few pottery and enamel manufacturers have purchased part or all of their feldspar requirements crude and have ground it as needed in their own mills. Certain makers of soap, cleansers, and sweeping compounds also mine or purchase crude feldspar, largely from New England, Virginia, and North Carolina, and after grinding or otherwise processing it utilize the abrasive properties of the spar in their products. Manufacturers of artificial teeth annually use a small tonnage of carefully selected crude material, which must be free of all grit and is sold at a substantial premium over No. 1 grade commercial feldspar.

Ground feldspar.—Sales of ground feldspar to the ceramic industries in the United States annually constitute more than 95 percent of the total shipments. Most of the ground spar consumed is sold to glass and pottery manufacturers. Reflecting the higher output of glass products in 1943, shipments to the glass industry totaled 214,668 short tons, a record amount, and were 64 percent of the total sales, compared with 60 percent in 1942. Sales to potteries decreased to 29 percent or 3 points below the 1942 figure; however, the manufacture of vitreous porcelain was especially active owing to the increased war demand. Continued conversion of enamelware plants to the annealing of steel and to other war purposes, as well as lack of necessary priorities, cut shipments to these consumers in 1943 to about half those reported for 1942. Sales of feldspar for use in soaps and abrasives in 1943, however, were more than twice the 1942 level. The remainder of the ground spar sold by merchant mills in 1943 was utilized for miscellaneous ceramic purposes other than glass, pottery, or enamel and for various other purposes, most of them unspecified. A minor application with respect to tonnage but important to many war industries is its employment in welding-rod coatings.

Ground feldspar sold by merchant mills in the United States, 1941–43, by uses

Use	1941		1942		1943	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ceramic:						
Glass	182,878	51.6	195,601	59.7	214,668	63.9
Pottery	127,140	35.9	106,081	32.4	97,887	29.2
Enamel	34,841	9.8	13,899	4.2	7,147	2.1
Other ceramic uses	563	.2	6,459	2.0	1,261	.4
Soaps and abrasives	1,490	.4	4,396	1.3	9,481	2.8
Other uses	7,505	2.1	1,350	.4	5,366	1.6
	354,417	100.0	327,786	100.0	335,810	100.0

Shipments of ground feldspar into consuming States in 1943 indicated increased consumption in certain southern States, particularly West Virginia, Oklahoma, and Texas. Small increases also were noted in shipments to Indiana, Maryland, Massachusetts, and Wisconsin. Other States for which comparisons are possible showed smaller totals than in 1942. In 1943 shipments to Illinois comprised 15 percent of the total shipments; West Virginia, 15 percent; Ohio, 13 percent; Indiana, 12 percent; New Jersey, 12 percent; Pennsylvania, 11 percent; and New York, 5 percent. Sizable shipments also were made to Maryland, Oklahoma, Texas, and Wisconsin.

The following table shows shipments of ground feldspar for the 5-year period 1939–43, by destination of shipments as reported by merchant grinders.

Ground feldspar shipped from merchant mills in the United States, 1939–43, by destinations, in short tons

Destination	1939 [1]	1940	1941	1942	1943
California	7,590	7,897	10,444	12,224	8,669
Illinois	15,948	32,811	44,573	50,450	49,302
Indiana	38,189	28,634	39,620	38,998	40,873
Maryland	(2)	(2)	(2)	8,745	9,028
Massachusetts	(2)	(2)	(2)	3,630	3,855
New Jersey	34,309	42,381	44,249	43,029	40,259
New York	14,995	13,236	18,326	18,363	18,024
Ohio	53,410	50,835	52,270	43,950	42,536
Oklahoma	(2)	(2)	(2)	8,002	(2)
Pennsylvania	37,466	47,431	54,534	40,013	36,190
Tennessee	5,077	5,911	9,697	3,507	2,677
West Virginia	19,188	21,889	29,916	35,161	48,940
Wisconsin	5,134	6,967	10,517	7,837	8,718
Other destinations [3]	25,463	27,721	40,271	13,877	26,739
	256,769	285,713	354,417	327,786	335,810

[1] Data include 99 percent of total ground feldspar.

[2] Included under "Other destinations"; separate figure for State not available.

[3] Includes Arkansas, Colorado, District of Columbia, Hawaii, Kentucky, Louisiana, Maryland (1939–41), Massachusetts (1939–41), Michigan, Minnesota, Mississippi, Missouri, Oklahoma (1939–41, 1943), Puerto Rico, South Carolina, and Texas, and other States (shipments to which cannot be segregated); also small shipments to Canada, England, and Mexico.

NEPHELINE SYENITE

Nepheline syenite continued as an active competitor of feldspar in 1943. When first mined virtually the entire output was used in the manufacture of glass where its high alumina content proved to be both economical and beneficial. More recently, after extensive research had been undertaken, increasing amounts have been utilized in various types of ceramic bodies. Nepheline syenite of pottery grade is finely ground, whereas that for the glass trade is granular material. A residue or dust remaining from grinding operations is sold to enamel and colored-glass manufacturers, as a substitute for pumice for grinding and polishing, as a cleanser, and in the heavy-clay industries.

Nepheline syenite has not been produced commercially in the United States. Canadian production in recent years has been reported largely from Methuen Township, Peterborough County, Ontario; smaller quantities come from the Bancroft-Gooderham district, Hastings County, also in Ontario. Operation of the Port Coldwell deposit on the northern shore of Lake Superior, mentioned in Minerals Yearbook, 1942, apparently has not progressed beyond the development stage.

A large part of the Canadian output of nepheline syenite is shipped into the United States in crude form, principally to Rochester, N. Y., to be ground and distributed to consuming industries in this country. Some nepheline syenite, however, is ground before importation. Imports of crude nepheline syenite increased 20 percent in 1943 compared with 1942 and again reached a new high. Ground nepheline syenite imported into the United States in 1943 was slightly more than half the figure reported for 1941, although considerably in excess of that imported in other recent years. All receipts of crude and ground nepheline in this country originated in Canada.

Nepheline syenite imported for consumption in the United States, 1939–43

Year	Crude		Ground		Year	Crude		Ground	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1939	29,231	$95,453	--------	--------	1942	35,990	$120,688	4	$44
1940	27,888	87,162	6	$25	1943	43,105	150,225	737	7,680
1941	35,799	112,101	1,359	13,695					

According to Canadian Chemistry and Process Industries, quotations on processed nepheline syenite during 1943 remained at the same levels as in 1942: Grade A, 20-mesh, bulk, in carlots, $11.75 per ton, f. o. b. Lakefield, Ontario; grade A, 200-mesh, bulk, in carlots, $16.50 per ton, f. o. b. Kingston, Ontario; and grade B, dust, bulk, in carlots, $10 per ton, f. o. b. Lakefield, Ontario.

Nepheline also is available as a byproduct of phosphate-rock recovery on the Kola peninsula in Soviet Russia. Some attempt has been made to use this material, but no production statistics have been published.

APLITE

Sales of ground "aplite" in 1943 were maintained at virtually the same high level as in 1942. By far the greater part of the output is marketed to glass manufacturers. Although of proved efficacy, extensive use of aplite, feldspar, or other feldspathic rocks for extinguishing incendiary magnesium bombs has not materialized.

The same two firms that operated in 1942 were actively engaged in the grinding of aplite in 1943: Dominion Minerals, Inc., Washington, D. C.; and Carolina Mineral Co., Erwin, Tenn. The grinding plants for both companies are near Piney River, Va.

TECHNOLOGICAL DEVELOPMENTS

Much interest has been manifest in the treatment of low-grade feldspar ores for the recovery of feldspar as a byproduct in flotation mills, designed primarily to treat other minerals. Two plants, including that of the Solvay Process Co., at Kings Mountain, N. C., that mill principally spodumene are marketing some byproduct spar. Two feldspar companies have reached the pilot-plant stage in the separation of feldspar by froth flotation. The Consolidated Feldspar Corporation also is building a new flotation plant at Kona, N. C., to treat the product of a 70-foot pegmatite containing 70 percent feldspar. The mica and quartz in the rock are so intimately associated with the spar that separation can be effected only by flotation. Scrap mica and commercial silica will be byproducts.

Iron-bearing feldspathic minerals are being actively investigated to find a way of removing the objectionable iron. One method consists of heating the minerals until friable, crushing and sizing, followed by magnetic separation.[2] Another process is designed particularly for treating aplite;[3] the rock is calcined at a temperature of 1,000° to 2,500° F. and acid-leached to dissolve most of the iron, the greater part of the original alumina content being unaffected. Fine grinding of feldspathic minerals with high quartz content to recover a high-grade spar has been described in a recent German patent.[4] In a paper delivered before the Milling Methods Division as a contribution to a symposium on flotation machines at the 1944 annual meeting of the American Institute of Metallurgical and Mechanical Engineers, the present status and possibilities in the froth flotation of feldspar and other minerals were discussed by S. H. Falconer and B. D. Crawford, of the Ore Dressing Laboratory of the American Cyanimid Co.

The use and effect of various opacifiers in feldspathic glaze compositions were studied by Beam.[5] Possible causes of variations in surface and other characteristics of electrical porcelain were sought in a study of the particle-size variation in commercial feldspars and flints.[6] Specific surface values were calculated. Unsuspected colloidal properties of some of the feldspars in the particle-size range below 3 microns were discussed.

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[2] Lawson, R. W., and Deneen, W. F., Treating Iron-Bearing Feldspathic Minerals: U. S. Patent 2,306,171, December 22, 1942 (July 17, 1941); Ceram. Abs., vol. 22, No. 2, February 15, 1943, p. 40.

[3] Brenner, R. F., and Dubble, R. D. (assigned to Dominion Minerals, Inc.), Treating the Rock Aplite and Making Ceramic Ware: U. S. Patent 2,304,440, December 5, 1940; Ceram. Abs., vol. 22, No. 2, February 15, 1943, p. 40.

[4] Feldspat-Strobel, G. m. b. H., Ceramic Raw Materials: German Patent 720,367, April 2, 1942 (class 1a, 35); Chem. Abs., vol. 37, No. 8, April 20, 1943, p. 2153.

[5] Beam, James R., Effect of Opacifiers on Fused Viscosity of Feldspathic Glazes: Jour. Am. Ceram. Soc., vol. 26, No. 7, July 1, 1943, pp. 205–212.

[6] Russell, R., Jr., and Weisz, R. S., Some Particulate Characteristics of Commercial Flint and Feldspar: Jour. Am. Ceram. Soc., vol. 27, No. 1, January 1, 1944, pp. 1–7.

Barium feldspars in Wales are described by Spencer.[7] Feldspar, principally soda spar, and a fluorspar-enriched product similar in composition to English Cornwall stone are produced in South Australia and shipped to other parts of that country.[8] Fluorescence of central European feldspars[9] and the minerals (including feldspar) of the Kirov district in the Murmansk region of the U. S. S. R. were studied by Chirvinskii.[10]

OTHER DEVELOPMENTS

Consolidated Feldspar Corporation was reported to have doubled the capacity of its mill at Louise, near Kingman, Ariz.[11] A brief description of the Strickland deposit at Portland, Conn., producing feldspar and mica from several operating mines, appeared about the middle of the year,[12] and the Big mine in Cheshire County, N. H., is reported again to be in operation, mining sheet mica and feldspar and recovering quartz and beryl as byproducts.[13] Milling operations at the Western Feldspar Milling Co. plant at Denver, Colo., are described by Torgerson.[14] Both feldspar and fluorspar are processed. Current milling practice at the Minpro unit of the United Feldspar & Minerals Corporation, near Spruce Pine, N. C., was described in detail in the trade press.[15]

IMPORTS

Feldspar.—Imports of feldspar into the United States in 1943 increased 25 percent in tonnage and 43 percent in value compared with 1942; average value per ton rose more than a dollar and reached $8.40 compared with $7.33 in 1942. The total value of the 1943 imports was the highest since 1930. As in former years, all imports originated in Canada.

Feldspar imported for consumption in the United States, 1939–43

Year	Crude		Ground		Year	Crude		Ground	
	Long tons	Value	Short tons	Value		Long tons	Value	Short tons	Value
1939	7,460	$52,141	2	$54	1942	9,525	$69,797	--------	--------
1940	12,522	80,274	--------	--------	1943	11,912	100,087	41	$417
1941	11,253	73,236	--------	--------					

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[7] Spencer, L. J., Barium Feldspars (Celsian and Paracelsian) from Wales: Mineral. Mag., vol. 26, 1942, pp. 231–245; Chem. Abs., vol. 37, No. 3, February 10, 1943, p. 583.

[8] Chemical Engineering and Mining Review, Feldspar and Chinastone in South Australia: Vol. 35, No. 414, March 10, 1943, p. 168.

[9] Kohler, Alexander, (The Luminescence of Feldspars Containing the Rare Earths): Ztschr. Kristal., Abt. B., Mineral. Petrog., mitt. 52, 1940, pp. 273–275; Chem. Zentr., vol. 1, 1941, p. 619; Chem. Abs., vol. 37, No. 7, April 10, 1943, p. 1675.

[10] Chirvinskii, P. N., The Mineralogy of the Kirov District in the Murmansk Region: Proizvod. Sily Kil'skogo Polusotrova, 1940, No. 1, pp. 27–55; Khim. Referat. Zhur. 4, vol. 40, No. 1, 1941; Chem. Abs., vol. 37, No. 7, April 10, 1943, p. 1676.

[11] Oil, Paint and Drug Reporter: Vol. 143, No. 24, June 14, 1943, p. 32D.

[12] Mining Congress Journal: Vol. 29, No. 5, May 1943, p. 71.

[13] Engineering and Mining Journal, "Big" Mine Produces Four Non-Metallic Minerals: Vol. 144, No. 4, April 1943, p. 80.

[14] Torgerson, Ralph S., Feldspar: Western Feldspar Milling Co. Supplies Large Tonnage of Ground Feldspar and Fluorspar for Many War-Stimulated Industries: Rock Products, vol. 46, No. 11, November 1943, pp. 42–43, 102.

[15] Engineering and Mining Journal, A Feldspar-Grinding Plant in North Carolina: Vol. 144, No. 8, August 1943, pp. 73–75.

Cornwall stone.—Although receipts in 1943 of both unmanufactured and ground Cornwall stone were several times those reported for 1942, imports were very much smaller than in most years preceding 1942. The United Kingdom is the sole source of supply. Continuing the trend of recent years, average values (foreign market value) in 1943 again increased—unmanufactured Cornwall stone to $14.26 per long ton compared with $13.80 in 1942, and ground material to $22.10 per ton compared with $18.40 in 1942.

Cornwall stone imported for consumption in the United States, 1939–43

Year	Unmanufactured		Ground		Year	Unmanufactured		Ground	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1939	1,684	$17,233	348	$3,965	1942	74	$1,021	5	$92
1940	2,261	20,812	228	2,758	1943	392	5,591	20	442
1941	2,736	31,138	182	2,658					

WORLD PRODUCTION

The United States is by far the largest producer of feldspar. Other countries reporting sizable outputs or exports in normal years have been Sweden, Norway, Germany (Bavaria), Canada, Finland, Czechoslovakia, and China, although no official figures for the last two nations mentioned have been published. Argentine and Australian shipments have increased in recent years, and Canadian shipments in 1943 were 16 percent higher than in 1942.

World production of feldspar from 1938 through 1943, so far as data are available, appears in the following table.

World production of feldspar, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina (shipments)	1,346	620	1,051	1,220	2,981	5,650	(2)
Australia:							
New South Wales [3]	162	178	(2)	(2)	(2)	(2)	(2)
South Australia [3]	669	502	615	1,072	1,081	(2)	(2)
Western Australia (exports)	3,031	2,919	3,853	3,561	(2)	(2)	(2)
Brazil	8,400	(2)	(2)	(2)	(2)	(2)	(2)
Canada (shipments)	19,365	12,753	11,306	19,464	23,623	20,203	23,499
Egypt	158	199	74	138	52	19	20
Finland (exports)	3,232	5,046	5,596	(2)	(2)	(2)	(2)
France	8,900	(2)	(2)	(2)	(2)	(2)	(2)
Germany: Bavaria	9,986	10,419	(2)	(2)	(2)	(2)	(2)
India, British	495	702	501	(2)	(2)	(2)	(2)
Italy	13,437	13,391	(2)	(2)	(2)	(2)	(2)
Norway (exports)	32,555	21,761	21,282	(2)	(2)	(2)	(2)
Rumania	2,587	1,690	(2)	(2)	(2)	(2)	(2)
Sweden	49,140	45,111	40,792	(2)	(2)	(2)	(2)
United States (sold or used)	272,842	199,267	257,534	295,430	344,299	[4]321,240	313,126

[1] In addition to countries listed feldspar is produced in China (Manchuria) and Czechoslovakia. Official figures of Czechoslovak output are not available, but it is estimated that the annual production is approximately 30,000 metric tons (Stat. Comm. Czechoslovak Ceram. Soc.).

[2] Data not available.

[3] Includes some china stone.

[4] Revised figure.

ASBESTOS

By Oliver Bowles and F. M. Barsigian

SUMMARY OUTLINE

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SUMMARY

Sales of asbestos of domestic origin in 1943—6,014 short tons—were 61 percent less than in 1942. Sales of chrysotile declined greatly, but those of amphibole showed little change. Most of the domestic production consists normally of the shorter grades of chrysotile, but the principal producer of these grades suspended operations temporarily in 1943 while opening up a new quarry. Because of the great decline in output, United States sales furnished only 1 percent of domestic requirements.

Canada supplied the larger part of United States needs of chrysotile, but the Canadian output consists chiefly of the nonspinning shorter grades. African chrysotile was imported in substantial quantities to supplement the supply of Canadian spinning fibers. Soviet Russia, Australia, and India are other sources.

Asbestos is an important mineral in the military program. The United States depends almost entirely for its supply of the critical grades on imports from Canada, Southern Rhodesia, and the Union of South Africa. The domestic contribution of critical grades is negligible.

Three types of asbestos—chrysotile, amosite, and blue—are needed for military use. Chrysotile grades fall in two categories—long fibers suitable for textiles and short fibers used in making asbestos paper, millboard, insulating cements, and a variety of asbestos-cement products such as shingles, flat and corrugated siding, and pipe. The long fibers equivalent to Canadian Groups 1, 2, and 3 and Rhodesian Grades C & G1 and C & G2 are regarded as critical because they are much in demand, and supplies are not as abundant as desired. Aside from a considerable tonnage used in sheet packing, the long fibers are employed in asbestos textiles. Their more important uses are in Navy cable, friction materials, packings and gaskets, cloth for the Maritime Commission and Navy, laminated plastics, and aircraft tape. The Rhodesian fibers are lower in iron than the Canadian; for this reason, their use is required for textiles used in Navy cable construction where electrical insulation is important. Supplies of asbestos textiles are short, and therefore they are carefully controlled and allocated under the provisions of Order M-283.

Amosite, mined only in Africa, is a critical variety that has important military uses, including woven insulation for ship work, 85-percent magnesia and other high-temperature molded insulations, fireproof marine insulating board, and sprayed-asbestos insulation. It is difficult to increase the production of amosite, and future requirements are not assured for as long a period as is desirable.

Blue asbestos, Grades MS and S, are imported from the Union of South Africa chiefly for the manufacture of asbestos-cement pipes, which have performed important functions as substitutes for iron pipe, thus freeing iron for more direct military uses. The supply of blue asbestos appears to be adequate, and therefore these grades were not as critical at the end of 1943 as they were early in the year.

Conservation Order M–79, as amended October 1, 1943, restricted the end uses of Rhodesian C & G1 and C & G2 and amosite Grades B–1, B–3 or D–3, and 3/DM–1 and placed certain restrictions on Canadian spinning fibers. One of its most important requirements was the stipulation that 1 ton of Rhodesian C & G3 be used with every 5 tons of Canadian Grade 3R in textile manufacture. Rhodesian C & G3 has always been regarded as a shingle fiber unsuited for textile use; but, with the cordial cooperation of manufacturers, large quantities of this lower-grade fiber were worked into textile products, thereby avoiding what might have been a serious shortage of spinning fibers.

In 1943 the entire supply of critical grades imported from the Union of South Africa and Rhodesia was purchased by the Metals Reserve Co. and allocated in accordance with the more urgent needs. The same procedure will be followed in 1944, although it is possible that blue fibers will be exempted from this requirement and will be handled through private negotiations. The Combined Raw Materials Board determines the distribution, between the United Kingdom and the United States, of the available supply of all critical grades.

Ample supplies of the shorter grades of chrysotile fibers were imported from Canada in 1943. Anthophyllite and tremolite, varieties of asbestos that are generally weak and brittle, are employed for welding-rod coatings, acid filters, and insulating cements, and as fillers in some products. They are produced in several countries but enter international trade to a very limited extent.

Salient statistics for asbestos in 1942 and 1943 are summarized in the following table.

Salient statistics of the asbestos industry in the United States, 1942–43

	1942		1943	
	Short tons	Value	Short tons	Value
Domestic asbestos—				
Produced:				
Chrysotile	13,109	(1)	1,731	(1)
Amphibole	2,208	(1)	2,214	(1)
Total produced	15,317	(1)	3,945	(1)
Sold or used by producers:				
Chrysotile	13,373	$480,245	3,900	$302,289
Amphibole	2,108	18,612	2,114	32,526
Total sold or used by producers	15,481	498,857	6,014	334,815
Imports (unmanufactured)	419,242	21,217,650	440,255	23,053,524
Exports (unmanufactured)	774	134,411	364	34,355
Apparent consumption [2]	[3] 433,949	[3] 21,582,096	445,905	23,353,984
Exports of asbestos products	(1)	5,116,919	(1)	4,876,500

[1] Figures not available.
[2] Quantity sold or used by producers, plus imports, minus exports.
[3] Revised figures.

The following table shows domestic production of asbestos during recent years according to varieties:

Asbestos sold or used by producers in the United States, 1939–43, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	15,043	$503,097	416	$9,691	15,459	$512,788
1940	18,672	664,520	1,388	9,988	20,060	674,508
1941	22,439	707,589	1,952	18,164	24,391	725,753
1942	13,373	480,245	2,108	18,612	15,481	498,857
1943	3,900	302,289	2,114	32,526	6,014	334,815

DOMESTIC INDUSTRY

REVIEW BY STATES

Arizona.—Sales of Arizona asbestos in 1943 totaled somewhat less than in 1942, but the value was considerably higher. Sales were made by the following companies: Arizona Chrysotile Asbestos Co., Arthur Enders, and Guy G. Phillips, all of Globe; Earl Pierce, of Young; and Johns-Manville Products Corporation, 22 East 40th Street, New York, N. Y., with mine and mill at Chrysotile.

High-grade iron-free chrysotile asbestos like that obtainable in Arizona has important special uses in the war program. Accordingly the Reconstruction Finance Corporation has authorized a loan of $25,000 to Pine Top Asbestos Mines which, supplemented by about $17,000 from other sources, will be used to develop properties of the company 37 miles northeast of Globe. The Defense Plant Corporation has agreed to advance $80,000 to the company for building a mill to handle the product of its own mines and to serve as a custom mill for small producers in the region. Limited progress had been made on these projects by the end of 1943.

California.—The only producer of asbestos in California making sales in 1943, as in 1942, was Kohler & Chase, miners of short-fiber chrysotile near Monticello, Napa County.

Georgia.—Production of asbestos in Georgia in 1943 was less than half as great as that in 1942. The only operator was again the Powhatan Mining Co., from its amphibole asbestos property near Dillard, Rabun County.

North Carolina.—Sales of asbestos in North Carolina were considerably larger in 1943 than in 1942. The Industrial Minerals Corporation, operating at Newdale, Yancey County, is the largest producer of amphibole asbestos in the United States. Substantial quantities were sold, chiefly for welding-rod coating. W. T. Hippey also produced a considerable tonnage of anthophyllite at Micaville, Yancey County.

Oregon.—Philip S. Hoyt and Mrs. Flora Winsenberg reported sales of small tonnages of tremolite asbestos to be used in making acid filters. The properties are near Grants Pass, Jackson County.

Vermont.—The Vermont Asbestos Mines Division of the Ruberoid Co. discontinued operation of its open-pit mine adjacent to the mill near Eden, Vt., but has developed a new operation in asbestos-bearing rock on the opposite slope of Belvidere Mountain. Rock from this source is conveyed over the mountain by an overhead cableway about 1 mile long. The deposit, which is said to be extensive, furnishes chrysotile fiber of nonspinning grades. Because of the change in source of raw material there was no production during 1943, but it was expected that the new tramway would come into operation with the advent of favorable weather in the spring of 1944 and that the mill would attain a normal rate of production during ensuing months. Asbestos sales during 1943 were made from stock on hand.

TRENDS IN CONSUMPTION

Domestic consumption of unmanufactured asbestos and value of exports of asbestos products during the past 20 years are indicated in the accompanying table. Consumption broke all previous records in 1943 and exports of asbestos products were exceeded in value only by those of 1942. The latest year for which the Bureau of the Census published data on manufactured asbestos products was 1939, when their value was $97,944,735.

Raw asbestos consumed in and asbestos products exported from the United States, 1924–43

Year	Raw asbestos—apparent consumption (short tons)	Asbestos products—exports (value)	Year	Raw asbestos—apparent consumption (short tons)	Asbestos products—exports (value)
1924	182,280	$2,529.795	1934	123,752	$2,142,514
1925	230,669	2,383,325	1935	174,655	2,261,929
1926	257,875	3,481,814	1936	250,922	2,479.273
1927	226,365	2,687,086	1937	316,263	3.047,078
1928	231,984	3.999,022	1938	187,150	2,533.916
1929	264,873	4,640,599	1939	255.547	3,354,920
1930	212,152	4,193,510	1940	262,199	3,473.248
1931	137,875	2,606.166	1941	438,741	4,835,194
1932	98,606	1,608,880	1942	[1] 433,949	5,116,919
1933	122,909	1,743,140	1943	445,905	4,876,500

[1] Revised figures.

The customary correlation of the asbestos industry with the manufacture of automobiles because of the importance of asbestos in brake bands and clutch facings is of no significance under current conditions, because automobile manufacture has been virtually suspended and has been superseded by the manufacture of airplanes, tanks, army trucks, jeeps, and mobile artillery, which have been and are being made in vast numbers. The large tonnages of asbestos formerly employed in commercial and pleasure cars now perform similar functions in military equipment. Other important uses are as packings, gaskets, boiler lagging, and pipe coverings at industrial plants. All these activities are included under industrial production, most of which was geared more or less directly to the military program in 1943.

Asbestos also finds wide application in the building industry, where it is employed for heat insulation and fireproofing. In this field also military construction has absorbed large quantities of asbestos products normally employed in private building.

The relation of asbestos consumption to industrial production and building construction is indicated in figure 1. The trends are strikingly similar from 1933 to 1941, but since that time industrial production has risen to such unparalleled heights that asbestos consumption could not keep pace with it. Asbestos production and fabrication had approached 100 percent of capacity, and importations from Africa had reached the limit of available transportation facilities by the end of 1941. Efforts to increase mine and mill output in 1943 were hampered to some extent by shortage of labor. The demands of greatly increased manufacturing activity have been met by careful conservation and by allocation of the critical grades of raw asbestos and their most essential products to urgent war needs. Credit for maintaining supplies in balance with war demands may be given to the War Production Board, the Combined Raw Materials Board, and the cordial cooperation with these agencies by the asbestos-producing and the manufacturing industries.

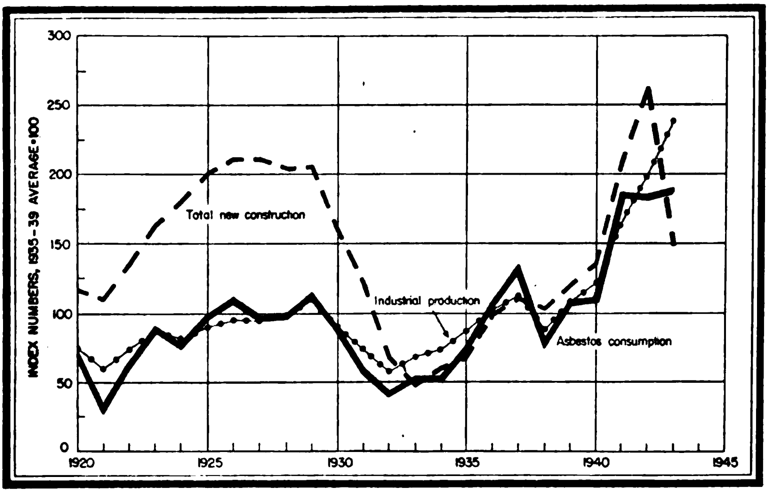

FIGURE 1.—Consumption of asbestos compared with total new construction and industrial production, 1920–43. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from the Bureau of Foreign and Domestic Commerce and on industrial production from the Federal Reserve Board.

MARKET CONDITIONS

Market trends throughout the year veered consistently from civilian to war needs. Demands were heavy, particularly for the long fibers. Supplies of spinning fibers were little in excess of immediate needs. Short fibers were adequate at all times to meet market requirements. While demands of private builders lagged, the requirements of asbestos-cement-products manufacturers were stimulated to some extent by the call for nonstrategic materials to substitute for critical metals.

PRICES

Prices of asbestos as quoted in E&MJ Metal and Mineral Markets show no change in 1943 from those quoted in 1942, which are given in full in the chapter on Asbestos in Minerals Yearbook, 1942, and therefore need not be repeated here.

NEW DEVELOPMENTS

Research work is now being conducted in Canada on a process for recovering magnesium chloride from serpentine tailings in the Quebec asbestos area. Magnesium chloride is used as a source of metallic magnesium, now employed extensively in the manufacture of munitions, which may find wide use under peacetime conditions. Profitable utilization of this waste product in Quebec is highly desirable because the spoil banks now comprise over 200,000,000 tons and are being increased at a rate of about 20,000 tons a day. Possible byproducts are salt cake, chlorine, silica, iron oxide, and chromite. A similar waste-utilization problem exists at all chrysotile-asbestos mining centers.

A new sound-deadening and vibration-reducing material having the trade name "Vibeston" is designed for use in airplanes to protect the hearing of flyers and to extend the life of the plane. No data are now available on its composition, but asbestos is an important component.

Glass wool is used to some extent as a substitute for asbestos in making wire coverings and some heat-insulating products, but asbestos is generally regarded as indispensable in making friction equipment. However, claims have recently been made that aluminum wool impregnated with rubber will give satisfactory service in automobile brake bands.

Interest has been renewed in a deposit of long-fiber chrysotile of good quality in northwestern Alaska on Dahl Creek, a tributary of the Kobuk River. Samples from this deposit were first sent to the Bureau of Mines in 1932. The deposit evidently consists of slip-fiber veins, the largest of which, according to present knowledge, is 3 inches across. The extent of the deposit has not yet been determined.

A use for asbestos that has attained recent prominence is in making protective asbestos felt to prevent corrosion of petroleum pipe lines. The pipe is first coated with tar, then by asbestos felt wound spirally. The Big Inch pipe line required 36,100 square feet of such felt per mile and the Little Inch 30,100 square feet per mile. However, the entire length of the pipe lines was not thus covered.

A special asbestos product, the nature of which cannot be disclosed at this time, has been developed for use as a rust-preventive coating for artillery in Africa where ordinary coatings are inadequate to resist the intense heat.

A new asbestos-cement product sold under the trade name "Stonewall" is said to be particularly adapted to replace metals urgently needed for war uses. The material may be applied to many types of construction.

POST-WAR OUTLOOK

Although asbestos has important war uses, many of them are equally applicable to a peacetime economy. For instance, asbestos gaskets, packings, and heat-insulating products now used in munition plants are employed in just the same ways in factories producing peacetime civilian goods. It is expected therefore that post-war asbestos consumption will approximate that of the years immediately preceding the war. It is possible, however, that the use of certain substitutes already mentioned will tend to reduce consumption to some extent.

Domestic output has never furnished more than a small fraction of domestic requirements. Although there is always the possibility of new and extensive discoveries, the expectation of finding them is remote, and there is little prospect of any substantial change in the domestic situation.

FOREIGN TRADE[1]

The following table shows imports of unmanufactured asbestos into the United States in 1942 and 1943. Total imports show a moderate advance in 1943. The most striking change, which reflects a marked improvement in the shipping situation, is an increase in imports of the high-grade African fibers of strategic quality to nearly double the quantity imported in 1942. Such large receipts of African asbestos were fortunate in view of the substantial decline in imports of Canadian crudes. The value of imports, which exceeded $23,000,000, was the highest in the history of the industry.

Asbestos (unmanufactured) imported for consumption in the United States, 1942–43, by countries and classes

Country	Crude (including blue fiber)		Mill fibers		Short fibers[1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942								
Africa:								
Southern Rhodesia	8,665	$1,386,782	-------	-------	-------	-------	8,665	$1,386,782
Union of South Africa	20,278	1,929,486	-------	-------	-------	-------	20,278	1,929,486
Australia	35	6,879	-------	-------	-------	-------	35	6,879
Bolivia	16	2,093	-------	-------	-------	-------	16	2,093
Canada	2,933	1,137,110	165,088	$11,410,219	218,600	$5,063,349	386,621	17,610,678
India and Dependencies	17	9,255	-------	-------	-------	-------	17	9,255
U. S. S. R	673	56,552	2,937	215,925	-------	-------	3,610	272,477
	32,617	4,528,157	168,025	11,626,144	218,600	5,063,349	419,242	21,217,650
1943								
Africa:								
Mozambique	802	106,564	-------	-------	-------	-------	802	106,564
Southern Rhodesia	28,555	3,768,346	-------	-------	-------	-------	28,555	3,768,346
Union of South Africa	24,007	2,379,879	-------	-------	2	61	24,009	2,379,940
Australia	3	1,018	-------	-------	-------	-------	3	1,018
Bolivia	22	1,805	-------	-------	-------	-------	22	1,805
Canada	1,870	708,282	161,783	10,849,793	222,002	5,128,990	385,655	16,687,065
India and Dependencies	65	38,034	-------	-------	-------	-------	65	38,034
U. S. S. R	302	21,050	842	49,702	-------	-------	1,144	70,752
	55,626	7,024,978	162,625	10,899,495	222,004	5,129,051	440,255	23,053,524

[1] Asbestos, n. e. s., containing not over 15 percent foreign matter.

The following table shows imports and exports of unmanufactured asbestos for the 5-year period 1939–43.

Asbestos (unmanufactured) imported for consumption in and exported from the United States, 1939–43

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1939	242,561	$9,094,538	2,473	$218,830
1940	246,613	10,034,433	4,474	449,105
1941	419,196	17,909,077	4,846	325,825
1942	419,242	21,217,650	774	134,411
1943	440,255	23,053,524	364	34,355

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

The following table shows exports of asbestos products in 1942 and 1943.

Manufactured asbestos products exported from the United States, 1942–43, by kinds

Product	1942		1943	
	Quantity	Value	Quantity	Value
Brake lining:				
Molded and semimolded..........short tons..	1,810	$1,706,624	793	$1,143,327
Not molded..........linear feet..	749,449	283,900	353,892	195,888
Clutch facing..........number..	1,432,442	558,515	1,282,190	554,561
Paper, millboard, and roll board..........short tons..	679	102,660	899	107,060
Pipe covering and cement..........do....	1,063	135,158	1,362	181,909
Textiles, yarn, and packing..........do....	1,017	1,154,161	975	1,132,411
Asbestos roofing..........squares..	97,668	169,331	54,896	305,243
Other asbestos manufactures, except roofing..........	3,002	780,725	2,753	639,149
short tons..	1,305	225,845	7,135	616,952
Magnesia and manufactures..........do....				
	....	5,116,919	....	4,876,500

WORLD PRODUCTION

The following table shows production of asbestos throughout the world, by countries, from 1937 to 1943, insofar as figures are available.

World production of asbestos, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina..........	....	....	110	150	84	95	(2)
Australia:							
South Australia..........	123	49	46	119	152	[3] 300	(2)
Tasmania..........	2	4	....	....	(2)		
Western Australia..........	43	123	279	364	(2)		
Bolivia..........	21	21	[4] 2	[4] 71	[4] 211	[4] 58	[4] 22
Brazil..........	....	120	45	500	[4] 13	(2)	(2)
Canada [5]..........	371, [illegible]67	262,894	330,642	313,504	433,492	398,669	423,831
China..........	(2)	(2)	(2)	100	(2)	(2)	(2)
Chosen..........	70	(2)	(2)	(2)	(2)	(2)	(2)
Cyprus (exports)..........	11,892	5,668	9,970	9,652	(2)	(2)	(2)
Finland [6]..........	7,260	(2)	(2)	(2)	(2)	(2)	(2)
France..........	250	(2)	(2)	(2)	(2)	(2)	(2)
Greece..........	2	85	(2)	(2)	(2)	(2)	(2)
India, British..........	102	90	266	[7] 1	[7] 32	[7] 15	[7] 59
Indochina..........	5	....	(2)	(2)	(2)	(2)	(2)
Italy..........	6,393	6,860	(2)	(2)	(2)	(2)	(2)
Japan (approximate)..........	1,000	1,000	1,000	1,000	(2)	(2)	(2)
Kenya Colony..........	....	5	(2)	(2)	(2)	(2)	(2)
New Zealand..........	(2)	(2)	(2)	....	54	43	(2)
Southern Rhodesia..........	51,722	53,352	52,900	[4] 52,518	[4] 49,191	[4] 56,546	(2)
Swaziland..........	....	....	7,233	18,873	(2)	(2)	(2)
Turkey..........	157	668	88	99	146	(2)	(2)
Uganda..........	....	53	(2)	(2)	(2)	(2)	(2)
Union of South Africa..........	25,975	21,025	20,003	24,849	[8] 25,655	[8] 31,351	[9] 24,120
U. S. S. R..........	125,000	86,000	(2)	(2)	(2)	(2)	(2)
United States (sold or used by producers)..........	10,958	9,471	14,024	18,198	22,127	14,044	5,456
Venezuela..........	(2)	(2)	(2)	20	(2)	(2)	(2)

[1] In addition to countries listed asbestos is produced in Bulgaria, Czechoslovakia, and Madagascar.

[2] Data not available.

[3] Estimate.

[4] Exports.

[5] Exclusive of sand, gravel, and stone (waste rock only), production of which is reported as follows: 1937, 3,611 tons; 1938, 2,975 tons; 1939, 3,535 tons; 1940, 5,880 tons; 1941, 7,669 tons; 1942–43, data not available.

[6] Includes asbestos flour.

[7] Imports into United States.

[8] Preliminary.

[9] January to September, inclusive.

CANADA

Canadian asbestos consists entirely of chrysotile, and all of it comes from the adjacent production centers of Thetford Mines, Black Lake, East Broughton, Vimy Ridge, and Asbestos in the Province of Quebec. Production has been continuous since 1878, and reserves are still very extensive.

The largest mine in the Quebec area is that of the Canadian Johns-Manville Co., Ltd. Other producers are Asbestos Corporation, Ltd., Johnson's Co., Bell Asbestos Mines, Ltd., Asbestos Crude & Fiber Mines, Ltd., Nicolet Asbestos Mines, Ltd., and Quebec Asbestos Corporation, Ltd.

Short fibers are the most abundant. A very small proportion of the total output consists of spinning fiber, and during recent years a downward trend in this proportion has been noted. This tendency is unfortunate at present, when the spinning grades are in greatest demand. The block-caving method of mining has been employed in the region for some years; and although it is more economical than deep open-pit work, especially for winter operation, the drop in percentage of crudes recovered is attributed to this newer method of mining, chiefly because there is limited opportunity for hand cobbing.

The following figures have been released by the Department of Mines, Province of Quebec.

Sales of asbestos in Canada, 1942–43, by grades

	1942			1943		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Grade:						
Crudes	2,890	$1,233,184	$426.71	2,016	$888.099	$440.53
Fibers	199,829	15,339,128	76.76	217,889	16,071,843	73.76
Shorts	236,741	6.090.971	25.73	247,291	6,209.563	25.11
	439,460	22,663,283	51.57	467,196	23,169,505	49.59
Rock mined	8,233,516			7,929,469		
Rock milled	6,795,459			6,828.532		

AFRICA

Southern Rhodesia.—No figures for Rhodesian asbestos production have been published since May 1940. Export data, however, are available, and as local sales are quite small exports are an approximate measure of production. It is apparent from the accompanying table that production in 1942 was the highest on record.

Asbestos produced in Southern Rhodesia, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	58,313	£1,088,782	1942 [1]	62,332	£1,811,042
1940 [1]	57,891	1,419,566	1943	[2]	[2]
1941 [1]	54,224	1,419,405			

[1] Exports.
[2] Data not available.

Union of South Africa.—The principal output of asbestos in the Union of South Africa consists of amosite, a variety produced commercially nowhere in the world except in the Transvaal. Crocidolite (blue asbestos) is next in importance. Incomplete figures indicate that the total yield in the Union in 1943 was a little higher than that in 1942 and the highest in the history of the industry. The following table shows production during recent years.

Asbestos produced in the Union of South Africa, 1939–43, by sources

Year	Short tons				Total value
	Transvaal	Cape Province	Natal	Total	
1939	15,827	6,144	79	22,050	[1] £517,535
1940	21,011	6,381	(2)	27,392	[3] 934,417
1941	[4] 21,704	[4] 6,576	(2)	[4] 28,280	[3] 990,756
1942	[4] 27,278	[4] 7,281	(2)	[4] 34,559	[3] 1,348,977
1943	[5] 20,785	[5] 5,803	(2)	[6] 35,000	[1] [5] 660,246

[1] Value of local sales plus value of exports.
[2] Data not available.
[3] Value of exports only.
[4] Partly estimated.
[5] January to September, inclusive.
[6] Preliminary total for year.

The following table shows the tonnage of each variety produced from 1939 to 1943, insofar as data are available.

Asbestos produced in the Union of South Africa, 1939–43, by varieties and sources, in short tons

Variety and source	1939 [1]	1940 [1]	1941 [2]	1942 [2]	1943
Amosite (Transvaal)	11,299	17,767	19,211	24,936	[3] 17,496
Chrysotile (Transvaal)	[4] 612	646	1,658	1,917	[3] 1,321
Blue (Transvaal)	3,983	2,520	776	360	[3] 1,895
Blue (Cape)	6,144	6,381	6,576	7,281	[3] 5,803
Anthophyllite (Transvaal)	12	78	59	65	[3] 73
	22,050	27,392	28,280	34,559	[5] 35,000

[1] Data from Union of South Africa, Department of Mines, Quarterly Reports.
[2] Partly estimated.
[3] January to September, inclusive.
[4] Includes 79 tons produced in Natal.
[5] Preliminary total for year.

Swaziland.—The Havelock mine began production in June 1939 and yielded about 18,000 tons in 1940. No figures are available for later years because of war restrictions, but its output has increased considerably and it probably operated at capacity in 1943. The output consists of chrysotile.

SOVIET RUSSIA

Russian asbestos deposits are extensive, and the quality of the fiber is good. The Soviet Union is unique among all important asbestos-producing countries in that it is also a large consumer of asbestos. No figures for production are available since 1938, when an output of 86,000 tons was reported. A large asbestos-products-manufacturing industry had been established before the war, and it seems probable that the industry has been expanded to provide for the automotive needs of the immense army. Asbestos-cement products are doubtless in heavy demand also for rebuilding war-devastated areas. Lack of Russian statistics leaves a wide gap in the world record of this important industry.

OTHER COUNTRIES

Organization of the Australian Blue Asbestos Co., Ltd., capitalized at £100,000, is reported by the foreign press. This company will engage in mining and processing high-grade blue asbestos in the Hamersley Ranges of Western Australia. The output will be marketed through the building materials division of the Colonial Sugar Refining Co. Small quantities of asbestos from this source now reach United States markets.

According to a recent report,[2] the origin of the fiber is quite similar to that of the blue asbestos occurring in South Africa. The deposits are said to be extensive, and with improved transportation facilities an important industry may be developed in this area.

The Bolivian blue asbestos industry has been almost dormant since the loss of its former markets in Japan, but sales to consumers in Argentina were reported in 1943.

No further progress was reported in 1943 on construction of the new mill or development of the chrysotile asbestos property near Tinaquillo, Venezuela.

According to news reports, a promising deposit of asbestos has been located near Yarumal, State of Antioquia, Colombia, South America. No data are available as to the nature or quality of the fiber.

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[2] Miles, Keith R., Part I, The Blue Asbestos Bearing Banded Iron Formations of the Hamersley Ranges, Western Australia; and Foxall, J. S., Part II, The Blue Asbestos Deposits of the Hamersley Range and Their Economic Importance: Western Australia Geological Survey Bull. 100, 1942, 61 pp.

BARITE, WITHERITE, AND BARIUM CHEMICALS

By Charles L. Harness and K. G. Warner [1]

SUMMARY OUTLINE

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SUMMARY

The most severe shortage of barite since World War I developed in the last few months of 1943, owing in part to increased demands for barite in well drilling, lithopone, chemicals, glass, and fillers and in part to the labor shortage. The labor shortage was caused by the requirements of Selective Service and by low wages, originally the result of low barite prices. Producers and Government agencies collaborated in the latter part of 1943 and the early months of 1944 in working out adjustments in wages and prices that would result in increased production. In Georgia and Tennessee wage increases approved by the War Labor Board were generally 10 to 15 cents an hour, and price increases approved by the Office of Price Administration $1 to $2.50 a long ton. Missouri wages and prices had not been settled by June 1, 1944; producers there were asking approximately 10 to 15 cents an hour increase for labor and $1.50 a short ton increase in the price of barite.

The production of crude barite in the United States in 1943 was 429,298 short tons compared with 449,873 tons in 1942. Consumption in 1943 was 434,774 tons, distributed as follows: For well drilling, 144,452; for chemicals, 81,547; for lithopone, 128,073; for glass, 25,464; for paint filler, 15,000; for rubber filler, 8,000; and for other purposes, including grinding losses, 32,238.

Salient statistics of the barite, witherite, and barium chemical industries in the United States, 1939–43

	1939	1940	1941	1942	1943
Barite:					
Crude:					
Produced . . . short tons	365,870	390,462	483,391	449,873	429,298
Sold or used by producers:					
Short tons	383,609	409,353	503,156	429,484	420,343
Value: [1]					
Total	$2,344,103	$2,596,743	$3,134,234	$2,673,002	$2,796,776
Average	$6.11	$6.34	$6.23	$6.22	$6.65
Imports for consumption:					
Short tons	11,588	7,391	456	4,680	----------
Value: [2]					
Total	$55,985	$41,342	$2,518	$34,756	----------
Average	$4.83	$5.59	$5.52	$7.43	----------
Apparent new supply [3] . . . short tons	395,197	416,744	503,612	434,164	420,343
Domestic . . . percent	97.1	98.2	99.9	98.9	100
Reported consumption (total) short tons	391,683	404,388	490,833	449,424	434,774

See footnotes at end of table.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Salient statistics of the barite, witherite, and barium chemical industries in the United States, 1939–43—Continued

	1939	1940	1941	1942	1943
Barite—Continued.					
Ground (and crushed):					
Sold or used by producers:					
Short tons	170,695	184,390	234,877	178,765	208,252
Value	$2,902,973	$3,697,806	$4,606,832	$3,611,745	$3,743,919
Imports for consumption:					
Short tons	1,590	314	----------	----------	----------
Value	$14,999	$3,299	----------	----------	----------
Witherite:					
Imports for consumption:					
Short tons	3,819	3,584	4,790	3,066	448
Value	$64,106	$70,126	$107,238	$60,824	$9,452
Barium chemicals:					
Sold by producers: [4]					
Short tons	40,989	46,399	61,083	64,459	73,040
Value	$2,330,167	$2,670,520	$4,812,939	$6,993,695	$8,092,858
Imports for consumption:					
Short tons	3,205	191	317	385	212
Value	$172,490	$9,045	$15,944	$105,275	$33,120
Lithopone:					
Sold or used by producers: [5]					
Short tons	142,759	151,802	176,642	137,320	135,723
Value	$10,461,102	$10,197,897	$12,550,193	$10,828,924	$10,745,305
Exports of lithopone:					
Short tons	4,845	14,298	21,527	17,036	17,320
Value	$392,798	$1,112,362	$2,079,229	$1,733,698	$1,637,217

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[1] F. o. b. mine shipping point.

[2] Declared value f. o. b. foreign market.

[3] Barite sold or used by producers plus imports.

[4] Data for 1941–43 are calculated on a different basis from that used for 1939–40. Sales figures for 1939–40 include the producer's own consumption of barium chemicals in materials which the producer sold without further conversion; for example, where the firm produced blanc fixe and used it as an extender in titanium pigments such blanc fixe is included in "Sold by producers" in the 1939–40 data, but in the 1941–43 data it is not included in "Sold by producers" but is included in "Used by producers"; see table, "Barium chemicals produced and used or sold by producers in the United States, 1941–43." Data in 1939–40 do not include sales of barium chemicals made from purchased barium chemicals; for example, if a firm bought barium carbonate and converted it to barium nitrate, such barium nitrate is not included in "Sold by producers"; in 1941–43 such barium nitrate is included in "Sold by producers." In 1941–43 sales by one producer to another are not included in "Sold by producers" if the purchased material was used by the purchaser in the year reported; jobbing activities or resale of purchased material are not included.

[5] Exclusive of cadmium lithopone.

BARITE

CRUDE

PRODUCTION AND CONSUMPTION

Both production and consumption of crude barite were well maintained during the first half of 1943. Demand for barite in well drilling had slowed considerably in 1942 but increased in each quarter of 1943. Consumption of barite in lithopone, barium chemicals, glass, and fillers fluctuated very little during the first three quarters of 1943. On the whole, production met demand during the first three quarters of 1943, but in the fourth quarter a variety of circumstances converged to create a serious shortage. Factors contributing to the deficit were the manpower shortage, low wages, low prices, depletion of deposits, and increased demand in nearly all uses.

However, it seemed generally evident that the paramount cause of the shortage was lack of labor, a condition that was felt most severely in Tennessee and Georgia, though evident also in Missouri. A medium-size barite washer requires, as a minimum crew: 1 shovel operator, 5 truck drivers to haul the barite-bearing clay to the washer, 3 to 5 men at the bull pen (where the clay is broken up with a heavy stream of water, allowing the lumps of barite to fall through a grizzly into the log washer), 1 jigman, 1 mechanic, 1 watchman, and 1 foreman, a total of 13 to 15 men per shift. If two or three shifts are operated, the number of workers in each category (except the mechanic and watchman) must be doubled or tripled accordingly. Various schemes for the reduction of personnel have been proposed or put into effect during the first half of 1944. The Paga Mining Co., Cartersville, Ga., faced with a shortage of both trucks and drivers, installed a 1,700-foot pipe line from the cut to the washer. The barite is crushed at the cut and pumped as a slurry back to the washer. One Missouri operator has taught his truck drivers to operate a power shovel and to fill their own trucks, thus dispensing with a shovel operator.

Wages paid in Georgia and Tennessee during September 1942, "frozen" by Public Law 729, 77th Congress, 2d Session, effective October 2, 1942, were as follows: Common labor, 40 cents an hour; semiskilled labor (truck and tractor drivers, jigmen, and washermen), 40 and 45 cents an hour; and skilled labor (shovel operators, mechanics, welders, and carpenters), 60 to 78 cents an hour. The War Labor Board approved wage increases as follows: Common labor, 50 cents; semiskilled labor, 55 cents; and skilled labor, 80 cents an hour. Producers in Washington County, Mo., were asking similar wage increases for their employees, though with a wider range of permissive payment. Negotiations had not been completed by June 1, 1944.

Hand-mining of barite in Missouri, an industry of small proportions in recent years, faces further drastic curtailment because of a National Labor Relations Board finding[2] that hand miners were employees of the owners or lessees of the land being mined, to the extent that the landowners or lessees must bargain collectively with union representatives of the miners. The landowners, who previously understood the miners to be independent contractors, are now generally reluctant to let hand miners dig barite on their property, as they believe that the diggers, as employees, would have to be paid minimum wages of 40 cents an hour, a wage level which, it is claimed, discourages production by slow pick-and-shovel methods. The National Labor Relations Board decision was affirmed in the United States Circuit Court of Appeals for the Eighth Circuit[3] on November 4, 1942, and a writ of certiorari was denied by the United States Supreme Court on April 19, 1943.[4]

Some barite is still dug in the classical pick-and-shovel manner, but the quantity, as estimated from consumer's purchases, probably did not exceed 8,000 or 9,000 short tons in 1943.

To strengthen the financial position of barite miners, thus indirectly encouraging barite production, the Congress provided for a "depletion" deduction in filing income taxes. The Revenue Act of 1943 (Public Law 235, 78th Congress, 2d Session), Section 124 (a) (4) (A) states:

> In General.—The allowance for depletion * * * shall be, in the case of * * * barite, * * *, 15 per centum * * * of the gross income from the property during the taxable year, excluding from such gross income an amount equal to any rents or royalties paid or incurred by the taxpayer in respect of the property.

The War Production Board Materials Substitution and Supply List, Issue 12, April 15, 1944, classed barite in group I, F, for purposes of determining priorities and for indirect assistance to local Selective Service boards in determining the essentiality of barite miners.

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[2] National Labor Relations Board, Decisions and Orders: Vol. 37, November 28-December 31, 1941, pp. 662-672.

[3] Federal Reports, 2d Series, vol. 131, pp. 585-593.

[4] Supreme Court Reporter, vol. 63, p. 995.

Bureau of Mines engineers examined the Riverview barite claim (discovered in Stevens County, Wash., in 1940 by a hunting party) and concluded that there was an inferred reserve of 16,700 tons analyzing about 82 to 83 percent $BaSO_4$.[5]

Crude barite sold or used by producers in the United States, 1942–43, by States

State	1942		1943	
	Short tons	Value	Short tons	Value
Georgia	86,636	$483,261	98,680	$621,193
Missouri	146,270	943,131	124,147	872,044
Tennessee	83,291	624,584	52,593	383,007
Other States [1]	113,287	622,026	144,923	920,532
	429,484	2,673,002	420,343	2,796,776

[1] 1942: Alabama, Arkansas, California, Nevada, South Carolina, and Virginia. 1943: Arizona, Arkansas, California, Kentucky, Nevada (12,157 tons, $49,900), and South Carolina.

Producers of crude barite and witherite in the United States in 1943

[Producers of less than 1,000 short tons are not included]

Name and address	Mine or mill location (nearest town)	Method of recovery
ARKANSAS:		
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles, Calif.	Malvern	Flotation.
Magnet Cove Barium Corporation, Malvern	do	Do.
Milwhite Co., Inc., Cotton Exchange Bldg., Houston, Tex.	Magnet Cove	Unknown.
CALIFORNIA:		
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles.	El Portal	Shot from veins (barite and witherite).
Industrial Minerals & Chemical Co., 6th and Gilman Sts., Berkeley.	Washington	Shot from veins.
GEORGIA:		
Barytes Mining Co., Box 224, Cartersville	Cartersville	Washer.
Dellinger, Brown, & Duckett, Cartersville	do	Do.
T. E. Johnsey, Cartersville	do	Do.
New Riverside Ochre Co., Cartersville	do	Do.
Paga Mining Co., Cartersville	do	Do.
L. A. Wood Co., Sweetwater, Tenn	do	Do.
MISSOURI:		
Cadet Mining Co., Cadet	Cadet	Do.
Campbell Bros., Russellville	Cole Camp	Do.
Do	Russellville	Do.
J. E. Carter Mining Co., Potosi	Potosi	Do.
De Soto Mining Co., De Soto	Richwoods	Do.
Elliott Mining & Engineering Co., 1103 Vineyard Square, Jefferson City.	Henley	Do.
H. & P. Mining Co., Potosi	Old Mines	Do.
Fred Hornsey & Co., Potosi	Potosi	Do.
M. & B. Mining Co., Potosi	Old Mines	Hand-mined.
Midwest Mining Co., Box 87, Potosi	Richwoods	Washer.
Ozark Products Co., Box 190, Potosi	Cadet	Do.
Superior Mineral Co., Cadet	do	Do.
Whaley & Scott Mining Co., Box 111, De Soto	Richwoods	Do.
NEVADA:		
Barium Products, Ltd., Newark, Calif	Battle Mountain	Shot from veins.
California-Nevada Barytes Mines Division of The Glidden Co., 766 50th Ave., Oakland, Calif.	do	Do.
Do	Tonopah	Do.
SOUTH CAROLINA:		
Clinchfield Sand & Feldspar Corporation, 618 Mercantile Trust Bldg., Baltimore 2, Md.	Kings Creek	Do.
TENNESSEE:		
J. R. Dellinger, Cartersville, Ga	Athens	Washer.
Sweetwater Mining Co., Sweetwater	Sweetwater	Do.
Wolf River Corporation, Jamestown	do	Do.
L. A. Wood Co., Sweetwater	do	Do.

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[5] Bureau of Mines, Riverview Claim: War Minerals Rept. 168, March 1944, 3 pp.

Crude barite (domestic and imported) used in the manufacture of ground barite and barium chemicals in the United States, 1939–43, in short tons

Year	In manufacture of—			Total	Year	In manufacture of—			Total
	Ground barite [1]	Lithopone	Barium chemicals			Ground barite [1]	Lithopone	Barium chemicals	
1939	192,112	141,556	58,015	391,683	1942	200,443	144,821	104,160	449,424
1940	200,899	136,885	66,604	404,388	1943	225,154	128,073	81,547	434,774
1941	243,846	153,982	93,005	490,833					

[1] Includes some crushed barite.

Distribution of plants producing ground and crushed barite, lithopone, and barium chemicals and total consumption of crude barite and witherite in the United States in 1943, by States

State	Product manufactured	Plants [1]	Barite used (short tons)
Missouri	Ground barite and chemicals	3	54,616
California	Ground barite, lithopone, and chemicals	5	46,556
Delaware and New Jersey	do	6	45,544
Illinois	do	6	49,690
Colorado	Chemicals	1	238,368
Ohio	do	1	
West Virginia	do	3	
Kansas	Lithopone	1	
Maryland	do	1	
Pennsylvania	do	1	
Georgia	Ground barite and chemicals	2	
New York	do	2	
Arkansas	Ground barite	2	
South Carolina	do	1	
Tennessee	Ground and crushed barite	2	
Texas	Ground barite	1	
		38	434,774

[1] A plant producing more than 1 product is counted but once in arriving at State totals.

PRICES

Barite prices in 1943 were frozen as of the individual producer's highest price in March 1942 (as provided by Maximum Price Regulation 327, February 22, 1943, of the Office of Price Administration). In Georgia and Tennessee regular chemical-grade barite sold at $8 and $8.50 a long ton. Price ceilings approved by the Office of Price Administration, April 8, 1944, ranged from $9.50 to $11 a long ton.

Most Missouri producers had been selling chemical grade barite at $7 a short ton f. o. b. rail point when their prices were frozen by Office of Price Administration. Producers' requests for an area price of $8.50, effective for Washington County, Mo., were still pending on June 1, 1944. Missouri barite prices have varied widely in the past 80 years, for example (per short ton): 1861, $7; 1882, $8; 1890, $5; 1901, $3.52; 1910, $3.29; 1920, $10.17; 1930, $7.08; and 1940, $6.30.

WORLD PRODUCTION

Data on production of barite in foreign countries have been meager since the outbreak of war. Available figures are shown in the following table.

World production of barite, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Algeria	2,137	3,069	(2)	(2)	(2)	(2)	(2)
Argentina	-------	-------	768	2,680	4,174	7,083	(2)
Australia	3,152	3,231	4,205	4,725	4,990	5,916	(2)
Brazil (exports)	600	(2)	(2)	(2)	(2)	(2)	(2)
Canada	-------	-------	(2)	307	6,250	17,842	22,202
Chosen	8,400	(2)	(2)	(2)	(2)	(2)	(2)
Cuba	3,849	-------	12,000	16,105	13,223	(2)	(2)
Egypt	51	20	31	61	30	60	(2)
France	19,850	(2)	(2)	(2)	(2)	(2)	(2)
Germany:							
Austria	855	373	(2)	(2)	(2)	(2)	(2)
Baden	21,653	36,305	(2)	(2)	(2)	(2)	(2)
Bavaria	11,832	26,748	(2)	(2)	(2)	(2)	(2)
Prussia [3]	410,634	401,906	(2)	(2)	(2)	(2)	(2)
Saxony	432	230	(2)	(2)	(2)	(2)	(2)
Thuringia	6,790	15,315	(2)	(2)	(2)	(2)	(2)
Württemburg	192	-------	(2)	(2)	(2)	(2)	(2)
Greece	39,343	34,700	24,055	(2)	(2)	(2)	(2)
India, British	15,941	8,205	9,404	(2)	(2)	(2)	(2)
Indochina	45	50	155	185	(2)	(2)	(2)
Italy	45,202	48,169	(2)	(2)	(2)	(2)	(2)
Norway	70	-------	-------	(2)	(2)	(2)	(2)
Portugal	113	24	25	20	46	(2)	(2)
Southern Rhodesia	-------	91	50	(2)	(2)	(2)	(2)
Spain	-------	500	8,856	9,936	8,125	(2)	(2)
Union of South Africa	570	491	439	691	1,390	745	[4] 1,745
United Kingdom	74,485	77,543	(2)	(2)	(2)	(2)	(2)
United States	327,380	304,298	331,910	354,219	438,523	408,116	389,451

[1] In addition to the countries listed, barite is produced in China, Czechoslovakia, Eire, Japan, and U. S. S. R., but data on production are not available.

[2] Data not available.

[3] Official figures which, it is reported, cover only output of mines included under the mining law.

[4] January to September, inclusive.

Canadian Industrial Minerals, Ltd., has been mining and grinding barite near Walton, Nova Scotia, for oil-well drilling in Trinidad and Venezuela since 1941, and shipments in 1943 reached 20,135 short tons. Lithopone and barium-chemical manufacturers in the United States investigated the possibility of using crude Nova Scotia barite, and one lithopone producer bought a substantial trial shipment in the spring of 1944. The material appeared satisfactory for use in lithopone, but its strontium and calcium content may prove detrimental for chemical use. A typical analysis of Nova Scotia barite is Ba (as $BaSO_4$) 95.75, Ca (as $CaSO_4$) 1.80, Sr (as $SrSO_4$) 1.09, SiO_2 0.69, Fe_2O_3 0.76, Mn 0.04 percent, and F trace. Reserves, originally estimated at 1,500,000 tons, have been extended 250,000 tons by recent drilling.[6]

Barite is also produced near Golden, British Columbia, mostly for oil-well drilling. Total production of barite in Canada in 1943 was 24,474 short tons valued at $255,525 (Canadian) compared with 19,667 tons valued at $188,144 in 1942 and 6,890 tons valued at $74,416 in 1941.

The barite industry in Australia was reviewed in Mineral Trade Notes.[7] From 1885, when barite was first produced in Australia, until the end of 1942, 72,485 short tons were produced in the country. South Australia is the leading producing State, with a total output from 1910 to 1942, inclusive, of 58,064 tons; New South Wales ranks second. All production is from lenses and veins. The most productive area is said to be 2 miles south of Noarlunga, which is 24½ miles by rail from Adelaide. Consumption of barite in Australia in normal times is divided approximately as follows: 55 percent in paint, 19 in rubber, 9 in fillers, and the remainder in various products, including paper, batteries, glass, and chemicals. Neither lithopone nor blanc fixe is made in Australia at present, all requirements being imported. November 1943 prices of crude barite f. o. b. Adelaide were quoted at £6 to £3 a short ton, depending on grade.

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[6] The Northern Miner, vol. 29, No. 44, January 20, 1944, p. 17.

[7] Bureau of Mines, Mineral Trade Notes: Conf. Ser. 19, January 1944, pp. 20–27.

GROUND (AND CRUSHED)

SALES

Ground barite is used chiefly to weight oil-well drilling muds so that oil and gas may be confined to their levels and blow-outs prevented. The revival of well drilling in the last few months of 1943 placed considerable strain on facilities for grinding barite and led the Magnet Cove Barium Corporation and the National Lead Co. to enlarge their flotation plants at Malvern, Ark. The former built a complete second plant, whereas the latter installed individual units of larger capacity in its regular plant.

A shortage of glass barite seemed imminent in 1943, owing to the decreased production of Wolf River Corporation near Sweetwater, Tenn. However, experiments proved that glassmakers could use ground barite instead of the coarser crushed material formerly thought necessary. Barite is used in the glass batch to flux surface froth, which insulates the melt from furnace gases and slows heat transfer. Magnet Cove Barium Corporation, an affiliate of the Wolf River Corporation, undertook to supply the markets relinquished by Wolf River Corporation.

A considerable quantity of ground barite is bleached for use as a filler in white paints, rubber, cloth, wall paper, printing ink, and plastics. Unbleached barite may be used where a brown filler is permissible—for example, in linoleum, phonograph records, rope finishing, asbestos brake linings, and dark paints and rubber.

The following firms reported production of crushed or ground barite to the Bureau of Mines in 1943: Barium Products, Ltd., Newark, plant at Modesto, Calif.; Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles, Calif., grinding plants at Malvern, Ark., El Portal, Calif., and Fountain Farm, Mo.; Chemical and Pigment Division, The Glidden Co., Oakland, Calif.; Clinchfield Sand & Feldspar Corporation, 618 Mercantile Trust Bldg., Baltimore, Md., plant at Kings Creek, S. C.; Commercial Minerals Co., Inc., 310 Irwin St., San Francisco, Calif.; De Lore Division, National Lead Co., P. O. Box 2808, Carondelet Station, St. Louis, Mo.; Industrial Minerals & Chemical Co., 6th and Gilman Sts., Berkeley, Calif.; Magnet Cove Barium Corporation, Malvern, Ark.; George S. Mepham Co., 2001 Lynch St., East St. Louis, Ill.; Milwhite Co., Inc., Houston, Tex.; F. E. Schundler & Co., Inc., 600 Railroad St., Joliet, Ill., and 45 Vernon Ave., Long Island City, N. Y.; Southwark Manufacturing Co., Camden, N. J.; Thompson-Weinman Co., Cartersville, Ga.; Wolf River Corporation, Jamestown, Tenn.; and L. A. Wood Co., Sweetwater, Tenn.

Ground (and crushed) barite sold or used by producers in the United States, 1939–43

	1939	1940	1941	1942	1943
Plants	13	16	16	19	18
Short tons	170,695	184,390	234,877	178,765	208,252
Value	$2,902,973	$3,697,806	$4,606,882	$3,611,745	$3,743,919

Ground (and crushed) barite sold or used by producers, 1941–43, by consuming industries

Industry	1941		1942		1943	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Well drilling	154,760	66	117,380	66	144,452	69
Paint	31,009	13	18,484	10	15,000	7
Glass	22,615	10	21,895	12	25,464	12
Rubber	9,800	4	6,334	4	8,000	4
Undistributed	16,693	7	14,672	8	15,336	8
	234,877	100	178,765	100	208,252	100

Data in the foregoing table were compiled from grinders' estimates and may be somewhat inaccurate; however, figures covering consumption in well drilling and glass—the two largest individual uses—appear to be accurate, as the number of producers for these uses is small, and their figures showing actual shipments by firms were available to the Bureau of Mines. Consumption of ground barite in "Paint," "Rubber," and "Undistributed" has been estimated partly by the grinders and partly by the Bureau of Mines.

The Paga Mining Co., Cartersville, Ga., began operating in May 1944 its new auxiliary plant to recover barite fines from washer waste waters by tabling and flotation. Formerly 5 to 7 percent of the barite in the clay matrix was lost in the washing operation; the new plant is designed to recover the greater part of these fines, most of which fall within a range of 10- to 80-mesh.

PRICES

The price of ground barite delivered to oil wells in the Houston (Tex.) area was $23 to $27 a short ton in 1943. The royalty payment of $13 a ton is no longer required, as the patent on the use of barite in well drilling expired in 1943.[8] Ground, bleached barite, according to the Oil, Paint and Drug Reporter, was quoted at $25.35 a short ton in bags, carlots, at St. Louis, Mo. Unbleached material was quoted at $17.50 a short ton, bags, carlots, f. o. b. producing plant. Crushed barite for glass use was quoted at $11.50, $12.50, and $13.50 a long ton, bags, f. o. b. producing plants in Georgia and Tennessee.

WITHERITE

The Baroid Sales Division of the National Lead Co. mines a mixed witherite-barite near El Portal, Calif., and grinds the material without separation, mostly for oil-well drilling muds. The production of this mixture is reported as barite.

Northern England is virtually the world supplier of witherite, and modest quantities are imported into the United States from that source.

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[8] Stroud, B. K. (assignor to National Lead Co.), Application of Mud-Laden Fluids to Oil or Gas Wells: U. S. Patents 1,575,944–5, March 9, 1926, expiring March 9, 1943.

Witherite, crude, unground, imported for consumption in the United States, 1939–43

[Value at point of shipment]

Year	Short tons	Value	Year	Short tons	Value
1939	3,819	$64,106	1942	3,066	$60,824
1940	3,584	70,126	1943	448	9,452
1941	4,790	107,238			

According to Oil, Paint and Drug Reporter, witherite, 99 percent through 200-mesh, bags, carlots, works, was quoted at $43 a short ton in 1943.

BARIUM CHEMICALS

PRODUCTION

Statistics on the barium-chemicals industry are presented in the present chapter in considerably more detail than in the past. Heretofore only the quantity of barium chemicals sold for consumption outside the barium-chemicals industry has been reported. In the present chapter two new entries have been added, one showing production of barium chemicals, the other showing the quantities of barium chemicals used by the barium-chemicals industry in making other barium compounds.

Barium chemicals are used directly or indirectly for many war and essential civilian purposes. Lithopone was in heavy demand in 1943 and helped to relieve shortages of the more opaque titanium, zinc, and lead pigments. The shortage of drying oils has encouraged the use of lithopone in paints incorporating a synthetic resin binder.

Barium chloride is one of the principal barium salts. Besides being a source of other barium chemicals, it is used to purify salt brines for chlorine and sodium hydroxide manufacture, in the manufacture of coatings for photographic paper, as a flux in making magnesium alloys, and in finishing white leather.

Blanc fixe (precipitated barium sulfate) is used as a filler in white paint, rubber, linoleum, and other materials. Barium carbonate is used as a carbon carrier in case-hardening steel, in preventing efflorescence in structural bricks, and as a starting point in making other barium compounds, including the nitrate, oxide, peroxide, and hydroxide. The nitrate is used in green signal flares and explosives, the oxide in case-hardening steel, the peroxide in making hydrogen peroxide, and the hydroxide in beet-sugar purification and refining animal and vegetable oils.

Barium chemicals produced and used or sold by producers in the United States, 1941–43, in short tons

Chemical	Plants	Produced	Used by producers in other barium chemicals[1]	Sold by producers[1 2]	
				Short tons	Value
Barium chemicals:					
Carbonate (synthetic):					
1941	5	21, 857	5, 297	16, 298	$724, 977
1942	7	26, 024	10, 544	14, 905	830, 034
1943	5	29, 082	15, 287	13, 979	753, 832
Chloride (100 percent basis):					
1941	3	13, 873	994	12, 789	1, 038, 322
1942	3	13, 439	1, 722	11, 497	913, 290
1943	3	15, 379	5, 111	10, 545	942, 399
Dioxide:					
1941	2	(3)	(3)	(3)	(3)
1942	2	(3)	(3)	(3)	(3)
1943	3	4, 123	262	3, 915	884, 676
Hydroxide:					
1941	4	1, 695	755	1, 027	119, 062
1942	3	2, 327	66	2, 335	267, 572
1943	4	2, 761	54	2, 715	281, 138
Nitrate:					
1941	3	491		432	72, 539
1942	5	11, 547	600	10, 889	2, 136, 040
1943	5	12, 157		12, 324	2, 376, 631
Oxide:					
1941	2	(3)	(3)	(3)	(3)
1942	3	3, 922	3, 543	155	30, 752
1943	3	5, 189	4, 998	170	37, 925
Sulfate (synthetic):					
1941	6	22, 420	12, 832	10, 808	638, 272
1942	4	19, 716	13, 113	6, 426	416, 183
1943	5	20, 897	9, 907	11, 453	757, 527
Sulfide:					
1941	3	31, 406	31, 438		
1942	4	39, 802	39, 781	18	667
1943	3	35, 420	35, 266		
Other barium chemicals:					
1941	(4)	22, 337	4, 782	19, 729	2, 219, 767
1942	(4)	21, 618	443	18, 234	2, 399, 157
1943	(4)	17, 939		17, 939	2, 058, 730
Total barium chemicals:					
1941	[5] 11	114, 079	56, 098	61, 083	4, 812, 939
1942	[5] 13	138, 395	69, 812	64, 459	6, 993, 695
1943	[5] 13	142, 947	70, 885	73, 040	8, 092, 858

[1] Sales by 1 producer to another are included under "Used" if the purchased material was used by the purchaser in the year reported.

[2] Exclusive of purchased material.

[3] Included under "Other barium chemicals."

[4] Plants included in figures above.

[5] A plant producing more than 1 product is counted but once in arriving at grand totals.

Lithopone[1] sold or used by producers in the United States, 1939–43

	1939	1940	1941	1942	1943
Plants	11	11	9	9	9
Short tons	142, 759	151, 802	176, 642	137, 320	135. 723
Value	$10. 461, 102	$10, 197. 897	$12, 550, 193	$10, 828, 924	$10, 745, 305

[1] Exclusive of cadmium lithopone.

Lithopone [1] *sold or used by producers, 1941–43, by consuming industries*

Industry	1941		1942		1943	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints, enamels, and lacquers	132,691	75	109,216	80	103,860	76
Floor coverings and textiles	21,114	12	15,775	11	15,999	12
Rubber	3,547	2	1,047	1	1,078	1
Other	19,290	11	11,282	8	14,786	11
	176,642	100	137,320	100	135,723	100

[1] Exclusive of cadmium lithopone.

PRICES

Range of quotations on barium chemicals, 1941–43

	1941 [1]	1942 [1]	1943 [2]
Lithopone:			
Domestic, ordinary, delivered, bags..pound	$0.0385–$0.04¼	$0.04¼	$0.04¼–$0.04¾
Do..barrels..do	.041 – .04½	.04½	.04½
Titanated, bags..do	.05¼– .056	.056	.056
Do..barrels..do	.05½– .0585	.0585	.0585
Barium carbonate, precipitated, 200-pound bags, works..short ton	45.00 –65.00	$55.00 –65.00	55.00 –60.00
Barium chlorate, 112-pound kegs, New York pound	.45	.60	.36
Barium chloride, barrels, delivered zone 1 short ton	77.00 –92.00	77.00 –92.00	79.00 –92.00
Barium dioxide (binoxide or peroxide), drums, works..pound	.10	.10	.10 – .13
Barium hydrate, 500-pound barrels, works..do	.05½– .07	.06 – .07	.06 – .07
Barium nitrate, barrels..do	.08½– .12½	.10½– .12½	.11 – .12
Blanc fixe (dry):			
Direct process, bags, c. l., f. o. b. works short ton	70.00	70.00	70.00
By-product, bags, c. l., f. o. b. works..do	50.00 –60.00	60.00	60.00

[1] Quotations other than blanc fixe from Chemical Industries (formerly Chemical Markets), New York (monthly). Blanc fixe quotations from Oil, Paint and Drug Reporter.
[2] Oil, Paint and Drug Reporter.

FOREIGN TRADE

Barium chemicals imported for consumption in the United States, 1939–43

[Value at port of shipment]

Year	Lithopone		Barium dioxide		Blanc fixe (precipitated barium sulfate)		Barium chloride	
	Short tons	Value	Pounds	Value	Short tons	Value	Short tons	Value
1939	2,641	$130,893	350	$51	38	$1,891	39	$1,329
1940	--------	--------	--------	--------	--------	--------	--------	--------
1941	(1)	9	4,032	208	15	865	--------	--------
1942	--------	--------	40,992	2,119	28	1,357	36	15,770
1943	--------	--------	--------	--------	--------	--------	18	7,885

Year	Barium nitrate		Barium hydroxide		Barium oxide		Barium compounds (n. e. s.)	
	Short tons	Value	Short tons	Value	Pounds	Value	Short tons	Value
1939	100	$11,094	360	$19,975	22	$13	27	$7,244
1940	18	1,427	151	3,332	--------	--------	22	4,286
1941	--------	--------	292	10,791	--------	--------	8	4,071
1942	(2)	1	147	9,361	--------	--------	154	76,667
1943	--------	--------	151	9,850	--------	--------	43	15,385

[1] 112 pounds.
[2] 53 pounds.

Lithopone exported from the United States, 1939–43

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1939	4,845	$392,798	$81.07	1942	17,036	$1,733,698	$101.77
1940	14,298	1,112,362	77.80	1943	17,320	1,637,217	94.53
1941	21,527	2,079,229	96.59				

POST-WAR OUTLOOK

Many paint producers foresee a gloomy future for lithopone after the war because of the increasing availability of titanium pigments. On the other hand, wartime successes with the new lithopone water paints, which may be applied directly to wallpaper, may well carry over into peacetime.

Barite appears to have an assured post-war market in well drilling. No substitute has been found that equals barite in specific gravity, neutral effect on drilling mud, low cost, and ease of use.

If barite operations in Georgia and Tennessee continue to encounter increasing overburden, producers in Missouri may eventually find it possible to compete in eastern chemical and lithopone markets, despite the higher freight. Imports of German crude barite will probably be resumed, unless the $4 per ton duty is increased. In pre-war years imports totaled about 40,000 tons a year.

An interesting post-war possibility is the use of ground and floated Arkansas barite in making barium chemicals. In the past, lump barite, crushed to 4-mesh, has been used exclusively in making chemicals, for if ground material were reduced in the kiln, dust losses would be prohibitive. Strontium chemicals are made by digesting ground celestite (strontium sulfate) in a solution of soda ash, yielding the carbonate, and there seems to be no fundamental technological reason why barium carbonate could not be produced in the same manner. From the carbonate other barium chemicals could easily be produced.

POTASH

By Bertrand L. Johnson and K. G. Warner

SUMMARY OUTLINE

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GENERAL CONDITIONS

New records in production and sales of domestic potassium salts were made again in 1943. Nearly a million and a half tons of marketable potassium salts (1,428,840 short tons) containing 739,141 tons of equivalent potash (K_2O) were produced. (See fig. 1.) A somewhat smaller quantity (1,401,271 tons) was sold, which, according to reports from the producers, contained 732,151 tons of equivalent potash. Stocks of salts in producers' hands at the end of 1943 were larger than in any of the 3 previous years. Exports of both fertilizer potash and potash for chemical purposes were larger in 1943 than in 1942. Imports of potash for fertilizer use nearly tripled those in 1942, as a result of the delivery of considerable potash from the U. S. S. R. Domestic consumption of potash was about 680,000 short tons of K_2O—much the largest ever recorded.

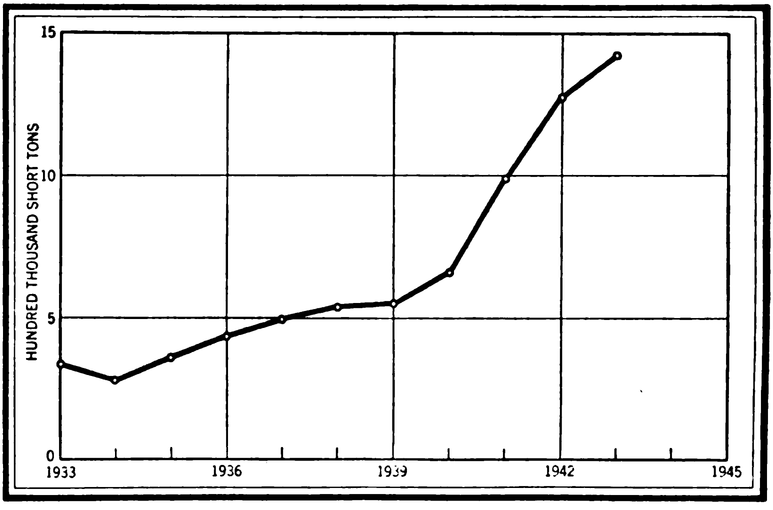

Figure 1.—Production of marketable potassium salts in the United States, 1933–43.

On June 9, 1943, Secretary of the Interior Harold L. Ickes issued an order (No. 1829) revoking the original order of 1935 restricting the granting of potash-development leases and authorizing the issuance of additional prospecting permits and leases for new potash development on the Public Domain when consistent with sound conservation policies and prevailing market conditions.

POST-WAR OUTLOOK

The present producing capacity of the domestic potash mines is more than enough to care for normal domestic requirements under peacetime conditions. Foreign competition will doubtless again be active, and the availability of foreign supplies will tend toward a decreasing demand for domestic potash in both the United States and foreign markets. However, exportation of food products to war-devastated countries may maintain production of potash at high levels for some time after hostilities cease.

General reviews of the potash industry in the war period by Turrentine[1] and Kieffer[2] and a discussion of fertilizers and fertilizer chemicals by Brand[3] appeared in 1943. A short statement (Document 17199) issued June 12, 1943, by the Office of Price Administration outlined the situation in the potash industry in stating the considerations involved in the issuance of Maximum Price Regulation 404—Potash.

Salient statistics of the potash industry in the United States, 1941–43

	1941	1942	1943
Production:			
Potassium salts (marketable)....short tons..	986, 458	1, 267, 455	1, 428, 840
Approximate equivalent, K_2O....do....	524, 875	679, 206	739, 141
Sales by producers:			
Potassium salts....do....	994, 843	1, 277, 317	1, 401, 271
Approximate equivalent, K_2O....do....	531, 346	680, 831	732, 151
Value at plant....	$17, 368, 237	$22, 962, 518	$26, 183, 073
Average per ton....	$17. 46	$17. 98	$18. 69
Imports:			
Fertilizer materials....short tons..	49, 337	15, 895	45, 009
Approximate equivalent, K_2O....do....	13. 185	2, 915	17, 005
Value....	$1, 023, 927	$418, 787	$1, 287, 022
Chemical materials....short tons..	12, 918	5, 433	419
Approximate equivalent, K_2O....do....	2, 633	1, 444	104
Value....	$4, 702, 971	$1, 784, 671	$155, 834
Exports:			
Fertilizer materials....short tons..	91, 950	84, 402	111, 541
Approximate equivalent, K_2O [1]....do....	50, 573	[2] 42, 600	60, 142
Value....	$2, 592, 697	$2, 184, 044	$3, 168, 446
Chemical materials....short tons..	12, 883	13, 307	20, 133
Approximate equivalent, K_2O [1]....do....	6, 300	[2] 6, 520	9, 865
Value....	$2, 972, 137	$3, 611, 656	$3, 950, 542
Consumption:			
Apparent consumption: [3]			
Potassium salts....short tons..	952, 265	1, 200, 936	1, 315, 025
Approximate equivalent, K_2O....do....	490, 291	[2] 636, 070	679, 253
Actual sales for consumption:			
Approximate equivalent, K_2O....do....	490, 531	[2] 635, 408	684, 118

[1] Estimate by Bureau of Mines.
[2] Revised figures.
[3] Quantity sold by producers, plus imports, minus exports.

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[1] Turrentine, J. W., Potash in War Production: Chem. and Eng. News, vol. 21, November 10, 1943, pp. 1793–1797.

[2] Kieffer, D. C., Potash and Superphosphate Supplies and Problems: Nat. Fertilizer Assoc., Proc. 19th Ann. Convention, 1943, pp. 18–25.

[3] Brand, C. J., Fertilizers and Fertilizer Chemicals in Wartime: Chem. and Eng. News, vol. 21, November 10, 1943, pp. 1788–1792.

DOMESTIC RESERVES

Domestic potash reserves comprise a variety of potassium-bearing minerals—sylvite, langbeinite, carnallite, polyhalite, alunite, leucite, greensand, sericite, and feldspar. To these should be added potash-bearing brines and cement-byproduct potash salts.

Sylvite, langbeinite, the brines, and cement-kiln flue dust only are being produced commercially. Alunite treatment has passed the pilot-plant stage, and commercial recovery of the potash content is expected shortly. The other potassium minerals constitute stand-by sources and await further technologic advances, development of marketable coproducts, depletion of the present productive deposits, or favorable economic changes before profitable production can be expected.

Sylvite, carnallite, and langbeinite have been found in an area of about 3,000 square miles in New Mexico and Texas. A smaller included area of some 100 square miles constitutes the New Mexico potash field. About 33 square miles of this smaller field contains beds of potash salts 4 feet or more thick which analyze at least 14 percent K_2O and contain 100,000,000 tons of potash salts, as estimated by the Geological Survey in 1933. One-fourth of these salts was estimated to contain over 28 percent K_2O. Later estimates, made about 1940 but before the intensive developments of recent years, placed the potash reserves of this area at 75,000,000 tons of equivalent K_2O. No current estimates are available, either of the total reserves or of the reserves of the individual potash salts recoverable at a profit under existing conditions.

The known high-grade potash salts of this district are now being consumed in large quantities, nearly 3½ million tons of crude sylvite and langbeinite (727,394 tons K_2O) being mined in 1943. The expectation of life of these reserves is being proportionately shortened. The average K_2O content of the crude sylvite mined annually is likewise becoming less; it has decreased from around 26 percent in the earlier years of mining in this district to 22.6 percent in 1943.

The potash-bearing brines now exploited at Searles Lake, Calif., were estimated to contain 10 to 12 million tons of K_2O in 1940. No estimates are available as to the currently productive shallow brines of the Salduro Marsh in Utah; but they are probably quite limited in extent, and little is known regarding the deeper brines.

Insufficient data are available for an estimation of the potash reserves of Grand County, Utah, where carnallite appears to be the most abundant potash salt but where sylvite and polyhalite also occur.

Reserves of alunite in the Marysvale district, Utah, are not definitely known. Reserves of alunitized rock were estimated by the Geological Survey in 1941 to total 36,921,000 tons, of which 10,324,600 are alunite. Only 1,361,000 tons are said to contain 50 percent or over of alunite. The Bureau of Mines gives somewhat larger figures.

Other potash-bearing minerals that may be utilized in the future include polyhalite, carnallite, leucite, greensand, sericite, and feldspar. Polyhalite is the most abundant and widely distributed potash mineral in the Permian Basin and is known to occur in minable thickness at several localities in New Mexico and Texas. Reserves are unknown but are probably large. Carnallite occurs both in the New Mexico and the Utah fields. Reserves are not known in either field. The leucite-bearing rocks of the Leucite Hills, Wyo., likewise a possible source of supply, have been estimated to contain nearly 200 million tons of potash. The potash-bearing silicate glauconite occurs in the greensand deposits of the Atlantic and Gulf coasts. The richest deposits are in New Jersey and Delaware and have been estimated to contain 257 million tons of K_2O. Sericite and feldspar are less important possible sources of potash.

PRODUCTION AND SALES

The annual increase in the production of marketable potassium salts in the United States since 1934 was in evidence once more in 1943, and again it was large; however, it was much less than the percentage increases in the last 2 years, being but 13 percent over 1942 compared with a 28-percent increase in 1942 over 1941 and a 50-percent increase in 1941 over 1940. The approximate equivalent K_2O content, however, was only 9 percent greater in 1943 than in 1942. Production in 1943 was 1,428,840 short tons, having an average K_2O content of 51.73 percent compared with 53.59 percent in 1942. Production of equivalent potash (K_2O) in 1943 exceeded that of 1942 by 59,935 tons. Sales of potassium salts were nearly a million and a half tons (1,401,271 tons) in 1943, a 10-percent increase over 1942. The contained equivalent potash (K_2O) was 732,151 tons, an increase of only 8 percent over 1942. Production exceeded sales in 1943, and producers' stocks were larger at the end of the year than at the beginning, increasing from the recent low point of 14,158 tons at the end of 1942 to 43,591 tons on December 31, 1943. The average value per ton of the potassium salts sold increased from $17.98 in 1942 to $18.69 in 1943. Production of all types of marketable potassium salts listed in the following table was larger in 1943 than in 1942.

Potassium salts produced in the United States, 1941–43, by grades, in short tons

Grade	1941	1942	1943
Muriate of potash: 60–62 percent K_2O minimum	663, 608	878, 997	934, 961
48–50 percent K_2O minimum	85, 398	85, 680	90, 137
Manure salts, run-of-mine	154, 979	183, 404	242, 189
Sulfate of potash and sulfate of potash-magnesia	82, 473	119, 374	152, 553
	986, 458	1, 267, 455	1, 428, 840

The western character of the domestic potash industry became still more pronounced in 1943 with the increased production of the Western States and the lessened output of the East. Virtually all (99.9 percent) of the 1943 output, in terms of K_2O, came from California, New Mexico, and Utah. About 82½ percent of the equivalent K_2O production in 1943 came from the deeply buried Permian saline sedimentary deposits of New Mexico and nearly 17½ percent from the saline lake brines of California and Utah, whereas less than 0.1 percent was recovered as a byproduct from manufacturing processes (cement and distillery operations in Maryland). The potash salts sold in 1943 were largely refined or processed products.

The potash-producing companies in the United States in 1943, by States, were as follows:

California:
- The American Potash & Chemical Corporation, 122 East 42d Street, New York City (plant at Trona, on Searles Lake, Calif.).

Maryland:
- North American Cement Corporation, 41 East 42d Street, New York City (plant at Security, Md.).
- U. S. Industrial Chemicals, Inc., 60 East 42d Street, New York City (plant at Baltimore, Md.).

New Mexico:
- International Minerals & Chemical Corporation, 20 North Wacker Drive, Chicago, Ill. (mine and plant near Carlsbad, N. Mex.).
- Potash Company of America, Carlsbad, N. Mex. (mine and plant near Carlsbad, N. Mex.).
- United States Potash Co., Inc., 30 Rockefeller Plaza, New York City (mine and plant near Carlsbad, N. Mex.).

Utah:
- Bonneville, Ltd., 540 West Seventh South, Salt Lake City, Utah (plant near Wendover, Utah).

Potassium salts produced, sold, and in producers' stocks in the United States, 1939–43

Year	Production			Sales				Producers' stocks		
	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Value f. o. b. plant	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)
1939	6	546, 757	312, 201	6	634, 014	366, 287	$12, 028, 195	5	54, 233	29, 440
1940	7	658, 249	379, 679	7	677, 892	393, 058	12, 562, 050	7	35, 060	16, 370
1941	7	986, 458	524, 875	7	994, 843	531, 346	17, 368, 237	7	26, 374	9, 712
1942	7	1, 267, 455	679, 206	7	1, 277, 317	680, 831	22, 962, 518	7	14, 158	6, 041
1943	7	1, 428, 840	739, 141	7	1, 401, 271	732, 151	26, 183, 073	7	43, 591	13, 984

PRICES

Price lists for the 1943–44 fertilizer season were released by the major potash companies on dates ranging from April 7 to May 1, 1943, whereas in 1942 the release dates ranged from May 29 to June 15. Most of the schedules covered the 12 months from June 1, 1943, to May 31, 1944. The following base prices were reported by various producing companies:

Muriate of potash (62 to 63 percent K_2O, 62 percent K_2O minimum).	53½ cents per unit K_2O.
Muriate of potash (60 percent K_2O minimum)	53½ cents per unit K_2O.
Muriate of potash, granular (48 to 52 percent K_2O, 48 percent K_2O minimum).	56 cents per unit K_2O.
Muriate of potash, granular (50 percent K_2O minimum).	56 cents per unit K_2O.
Manure salts:	
22 to 26 percent K_2O, 22 percent K_2O minimum, run-of-mine.	20 cents per unit K_2O.
22 percent K_2O minimum	20 cents per unit K_2O.
Sulfate of potash (90 to 95 percent K_2SO_4, basis 90 percent K_2SO_4).	$36.25 per short ton.
Sulfate of potash-magnesia (basis 40 percent K_2SO_4, 18.50 percent MgO).	$26.00 per short ton.

Basing points for the New Mexico companies for muriate of potash were designated to be ex-vessel Atlantic and Gulf ports within the United States (ports designated by two of the companies), and for the American Potash & Chemical Corporation ex-vessel principal continental United States ports. Prices for manure salts, where stated, were based upon Carlsbad, N. Mex., only. Sulfate of potash and sulfate of potash-magnesia prices quoted by the International Minerals & Chemical Corporation were ex-vessel Atlantic and Gulf ports within the United States. At buyer's option muriate of potash could be purchased f. o. b. Carlsbad, N. Mex., at 11.2 cents per unit K_2O below ex-vessel price and f. o. b. Trona, Calif., for 8 cents per unit K_2O below net ex-vessel price at Pacific coast ports.

The split-discount system was continued. Seasonal discounts offered by the Potash Company of America, the International Minerals & Chemical Corporation, and the American Potash & Chemical Corporation were 8 percent from ex-vessel prices on orders accepted before July 1, 1943, for delivery (shipment in the case of the International company) in approximately equal monthly installments from June 1, 1943, through March 1944, and 4 percent additional upon completion of contracted deliveries. The United States Potash Co. allowed 8 percent discount from ex-vessel prices on orders placed for June delivery and on those placed before July 1, 1943, for equal monthly tonnage deliveries from June 1, 1943, to March 31, 1944, and 4 percent additional credit upon completion of contracted deliveries. On orders placed after June 30, 1943, and before October 1, 1943, for equal monthly tonnage deliveries October 1, 1943, to March 31, 1944, the International Minerals & Chemical Corporation and the United States Potash Co. allowed 4 percent discount from ex-vessel prices plus 2 percent additional upon completion of delivery (United States Potash Co.) and shipment (International) of the contracted tonnage. The Potash Company of America for this period offered only 2 percent discount from ex-vessel prices but allowed 4 percent on the completion of the delivery of the contracted tonnage. The American Potash & Chemical Corporation allowed no discounts after July 1, 1943; the three New Mexico companies allowed none after September 30, 1943. On manure salts the only two producers—the United States Potash Co. and the Potash Company of America—allowed the same percentage discounts as set forth for muriate of potash.

On June 12, 1943, the Office of Price Administration issued Maximum Price Regulation 404—Potash, effective June 18, 1943. This regulation covered muriate of potash, sulfate of potash, sulfate of potash-magnesia, and manure salts and placed under specific dollars-and-cents ceilings all sales of these salts by domestic producers of potash to fertilizer manufacturers. Maximum prices were also fixed on potash originating outside of the United States and imported into continental United States for sale and delivery to a fertilizer manufacturer within the United States and any of its Territories and possessions. Sales, purchases, and deliveries of imported potash, except to fertilizer manufacturers, were governed at that time by the provisions of the general maximum price regulation and by Revised Supplementary Regulation 12 (7 F. R. 10532; 8 F. R. 6111, 2035).

Second Revised Maximum Price Regulation 135, issued November

17, 1943, with an optional effective date on or after November 23, 1943, but not later than January 1, 1944, established dollars-and-cents maximum prices for every grade of mixed fertilizer, superphosphate, and potash, whose manufacture and sale are permitted by the War Food Administration.

CONSUMPTION

Consumption of potash salts in the United States and its possessions in 1943 was approximately 680,000 short tons of K_2O. The following table, based largely upon the deliveries of potash of domestic origin as reported by the American Potash Institute, would indicate actual sales for domestic consumption in the United States of 684,118 short tons. Apparent consumption, calculated by subtracting exports (70,007 tons) from the sum of the imports (17,109 tons) and producers' sales (732,151 tons), was 679,253 tons of K_2O in 1943.

Apparent domestic consumption of potassium salts, in terms of equivalent potash (K_2O) and its relationship to sales of domestic producers, as reported to the Bureau of Mines, for a period of years is shown in figure 2.

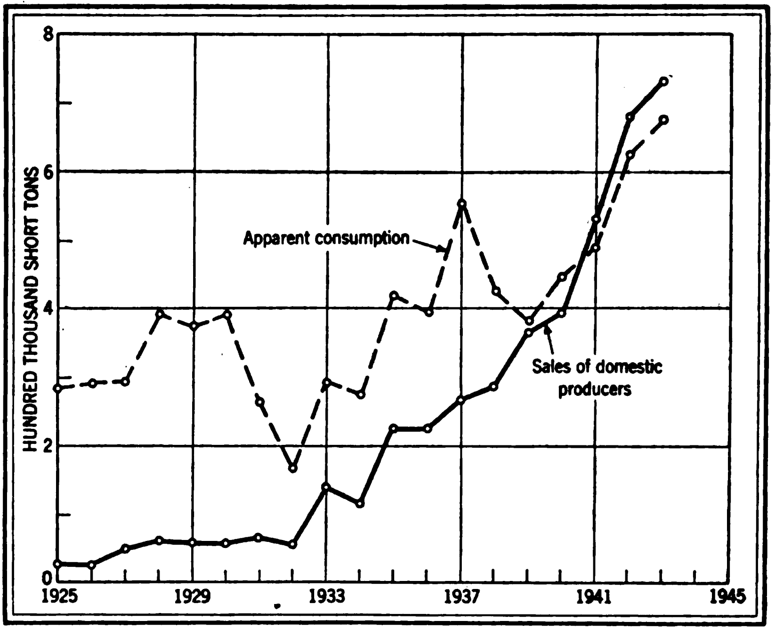

FIGURE 2.—Comparison of apparent domestic consumption of potash (K_2O) and sales by domestic producers of potash in the United States, 1925–43.

According to the figures of the American Potash Institute on potash deliveries, nearly 88 percent of the domestic deliveries of American potash in 1943 went to the fertilizer industry and a little over 12 percent for chemicals.

Sales of potash in the United States for consumption and export, 1941–43, in short tons of K_2O

	1941	1942	1943
Deliveries of primary potash of domestic origin by major companies, as from reports of American Potash Institute—			
In United States and possessions:			
Agricultural	435,940	558,356	591,210
Chemical	51,531	63,388	83,784
For export	24,807	38,504	47,907
	512,278	660,248	722,901
Imports for consumption plus sales of minor domestic producers	35,126	24,280	31,224
	547,404	684,528	754,125
Total exports (estimate by Bureau of Mines)	56,873	[1] 49,120	70,007
Actual sales for consumption in the United States	490,531	[1] 635,408	684,118

[1] Revised figures.

REVIEW BY STATES

General.—In 1943 merchantable potassium salts were produced in four States—California, Maryland, New Mexico, and Utah. The output of States (except for New Mexico, where there were three companies) cannot be given separately without disclosing individual company returns. New Mexico is by far the largest domestic producer, furnishing 84 percent of the total. California, although supplying much less than New Mexico, yields considerably more than the combined output of the other two States.

California.—The American Potash & Chemical Corporation (122 East 42d Street, New York City), only producer of potash in California in 1943, utilized the complex alkaline brine of Searles Lake in the southeastern part of the State as its potassium-bearing raw material and produced both agricultural and chemical grades of potassium chloride, as well as potassium sulfate. The brine is taken from a depth of 70 feet below the surface in wells and pumped 4 miles to the plant where[4] —

> After mixing with plant end liquors, it is sent to large triple-effect evaporators, concentrated, and separated into various salts, including borax, by carefully controlled fractional crystallization based on phase rule data. The solubilities of the carbonate, sulfate, and chloride of sodium being much lower, a large portion thereof is first precipitated and removed from the system. After further evaporation of the borax-potassium chloride-rich fraction, the potassium chloride is removed by rapid cooling under vacuum.

Maryland.—Two companies in Maryland produced byproduct potash for agricultural use in 1943. One of these producers—the Security plant of the North American Cement Corporation (41 East 42d Street, New York City), in Washington County, Md., a short distance east of Hagerstown—recovered several thousand tons of impure sulfate of potash from cement-kiln flue dust. In January 1943, U. S. Industrial

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[4] Curts, R. M., Production of Borax from Searles Lake Brine, American Potash & Chemical Corporation Process (supplementing motion-picture film): Am. Fertilizer, vol. 199, No. 7, September 25, 1943, p. 11; abs. of paper presented before Am. Chem. Soc. meeting, Div. of Fertilizer Chemistry, Pittsburgh, Pa., September 6–10, 1943.

Chemicals, Inc. (60 East 42d Street, New York City), manufactured a small quantity of byproduct potash-bearing material by incinerating waste residue from its distillation of industrial alcohol from fermented molasses at its Fairfield plant, Baltimore, Md.; no potash was produced thereafter because grain was substituted for blackstrap molasses, which was no longer available as a raw material for alcohol production.

New Mexico.—Mine production of potash salts in the Carlsbad region of New Mexico continues to increase, attaining new records annually. In 1943 the three companies operating in this area mined 3,433,243 short tons of sylvinite and crude langbeinite combined, almost 400,000 tons more than in 1942, when 3,035,549 tons were taken out. The average equivalent K_2O content of the mined salts decreased from 21.52 percent in 1942 to 21.19 percent in 1943. The average equivalent K_2O content of the sylvinite mined was 23.9 percent in 1940, 22.9 in 1941, 22.7 in 1942, and 22.6 in 1943.

All three companies mined sylvite (potassium chloride), and one—the International Minerals & Chemical Corporation—also mined langbeinite (a potassium-magnesium sulfate). The greater part of the mined production was sylvite, most of which was processed to yield 60-percent or higher-grade K_2O muriate. The production of merchantable potash salts in New Mexico in 1943 was 1,203,126 short tons (84 percent of the total domestic production), with an equivalent K_2O content of 609.638 tons (nearly 82½ percent of the total production). Sales were 1,178,570 tons (84 percent of the United States total), with an equivalent K_2O content of 604,414 tons (83 percent of the domestic total), valued at $21,918,503. Muriate of potash was produced by all three companies. Potassium sulfate and potassium-magnesium sulfate (sulfate of potash-magnesia) were produced from crude langbeinite by the International Minerals & Chemical Corporation in the refinery at its mine near Carlsbad. Potassium sulfate also was produced by the Potash Company of America.

The magnesium chloride plant of the Defense Plant Corporation, adjacent to the refinery of the International Minerals & Chemical Corporation at its mine, was completed early in 1943, and operation started on June 15, 1943. This plant is operated, on a fee basis, by the International. Magnesium-chloride cell feed is produced for use in the magnesium-metal plant owned by the Defense Plant Corporation at Austin, Tex., operated also by the International. The raw material for the Carlsbad plant is a waste potassium-magnesium-bearing brine, containing about 16 percent magnesium chloride. The magnesium chloride is obtained by evaporation and selective crystallization. The dried product is shipped to the Austin plant.

Late in February 1944 the United States Department of the Interior obtained bids for drilling certain potash areas in New Mexico near Carlsbad to permit further exploration for potash resources and to determine the quantity and grade of the potash deposits near Government well No. 23 in the Potash Reserve set up in 1931. This well, drilled several years ago about 15 miles northeast of Carlsbad, in NW ¼ sec. 35, T. 20 S., R. 29 E., Eddy County, N. Mex., disclosed an 11-foot bed of sylvite and halite, 5 feet of which contains more than 30 percent K_2O, said[5] to compare favorably in content and thickness with salts then being mined in Eddy County. Drilling was started on the new wells by the Bureau of Mines in cooperation with the Geological Survey about March 1, 1944.

Utah.—Interest was well-maintained in Utah during 1943 in all three types of potash occurrences—potassium-bearing brines, hydrothermal deposits of the potassium sulfate alunite, and bedded deposits of the potassium chlorides carnallite and sylvite. Commercial production of the brines continued, the alunites were under development, and the bedded chlorides were prospected by core drilling.

In 1943 Bonneville, Ltd. (540 West 7th South, Salt Lake City), was producing potassium chloride from brine at its plant near Wendover, Tooele County, Utah, close to the Nevada line on the Western Pacific Railroad from Salt Lake City. The brine utilized comes from the thin, saturated, crystalline salt mass of the Salduro Marsh near the western edge of the former Lake Bonneville, in the Great Salt Lake Desert in northwestern Utah. Operations at this plant were started in 1938; production increased annually to 1942, but in 1943 it fell to a little below the 1941 figures.

Considerable interest was evident in 1943 in the alunite deposits of the Marysvale district, although a more favorable aluminum situation and a large supply of potassium sulfate from other sources might influence future developments. The Bureau of Mines conducted some exploration on the deposits during the year. Some alunite was mined by Kalunite, Inc., and several thousand tons were shipped to Salt Lake City for treatment by its sulfuric acid process. This material was stock-piled at the company plant there. According to report this plant, erected for the treatment of Marysvale alunite by the Kalunite process, was operated for the first time in September 1943. It has a daily capacity of 100 tons of alumina. Many difficulties in operation were experienced, and during the remainder of the year there were numerous shut-downs to make technical adjustments. As a consequence, no commercial potash was produced. A summary of the Kalunite process is included in an article by Fleischer.[6]

Prospecting was in progress in 1943 in the Grand County potash field of eastern Utah. Late in 1942 the Potash Company of America (Carlsbad, N. Mex.) entered into a prospecting agreement with the Utah Magnesium Corporation whereby the former was to drill a number of deep wells and to prospect the holdings of the latter company near Crescent Junction on which earlier in 1942 the Defense Plant Corporation Reeder No. 1 well was drilled by the Bureau of Mines in cooperation with the Geological Survey.[7] The drilling operations in 1943 are reported to have been financed by the Potash Company of America. Drilling was started early in 1943, and four core holes are said to have been put down in this area during the year to depths of around 5,000 feet within a radius of about a mile of the Crescent Eagle well. No descriptions of the cores have yet been published. A paper[8] describing the earlier potash-bearing wells was presented at the New York meeting of the American Institute of Mining and Metallurgical Engineers in February 1944.

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[5] Mansfield, G. R., and Lang, W. B., The Texas-New Mexico Potash Deposits: Univ. Texas Bull. 3401, 1935, pp. 641–832.

[6] Fleischer, Arthur, Alumina from Alunite: Chem. and Met. Eng., vol. 51, No. 2, February 1944, p. 143. Summary of paper presented before Am. Inst. Min. and Met. Eng., New York meeting, February 20–24, 1944.

[7] Bureau of Mines, Thompson Magnesium Well, Grand County, Utah: War Minerals Rept. 12, 1942, 39 pp., 6 figs.

In September 1943 core drilling was reported to have been started about 2 miles east of Castle Dale, Utah, for the Dome Minerals Petroleum Co., of Salt Lake City, Utah, in a search for workable carnallite deposits.[9]

FOREIGN TRADE[10]

Imports.—As a result of current World War activities, imports of potash salts have shrunk from the several hundred thousand tons imported annually in pre-war years to a few thousand tons a year. In 1943, because of Lend-Lease imports of U. S. S. R. muriate of potash and larger receipts of Chilean potassium-sodium nitrate, imports of potassium salts more than doubled those in 1942, reaching 45,428 short tons estimated to contain 17,109 tons of K_2O. The total value of the imports, however, was much less because of greatly decreased imports of the high-valued argols.

Potash (K_2O) for fertilizer use constituted 67 percent of the total imports in 1942, whereas in 1943 fertilizer salts increased to over 99 percent of the total. Imports for chemical use dropped from 33 percent in 1942 to less than 1 percent of the total in 1943.

Potassium chloride (muriate) was the principal potash salt imported in 1943 for fertilizer use—25,212 tons out of the total of 45,009 tons. Virtually all of it came from the U. S. S. R. Imports of potassium-bearing materials for consumption in the chemical industries consisted principally of potassium bitartrate as argols and cream of tartar.

The stocks of the American Potash & Chemical Corporation and the Pioneer Potash Co. remain vested in the hands of the Alien Property Custodian (see Minerals Yearbook, 1942, pp. 1452–1453 and 1456).

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[8] Dyer, B. W., Potash in Eastern Utah: Am. Inst. Min. and Met. Eng. Tech. Pub. (in press).

[9] Mining World, Utah Concern Drilling for Carnallite near Castledale: Vol. 5, No. 10, October 1943, p. 33.

[10] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Potash materials imported for consumption in the United States, 1942–43

Material	Approximate equivalent as potash (K_2O) (percent)	1942				1943			
		Short tons	Approximate equivalent as potash (K_2O)		Value	Short tons	Approximate equivalent as potash (K_2O)		Value
			Short tons	Percent of total			Short tons	Percent of total	
Used chiefly in fertilizers:									
Muriate (chloride)	56. 4	1, 564	882	20. 2	$40, 195	25, 212	14, 220	83. 1	$705, 602
Potassium-sodium nitrate mixtures, crude	14. 0	14, 272	1, 998	45. 9	377, 703	19, 767	2, 767	16. 2	580, 760
Other potash fertilizer material [1]	60. 0	59	35	. 8	889	30	18	. 1	660
Total fertilizer		15, 895	2, 915	66. 9	418, 787	45, 009	17, 005	99. 4	1, 287, 022
Used chiefly in chemical industries:									
Bicarbonate	46. 0	1, 309	602	33. 1	52, 794			. 6	
Bitartrate:									
Argols	20. 0	4, 051	810		1,701,901	319	64		105, 505
Cream of tartar	25. 0					4	1		3, 617
Chlorate and perchlorate	36. 0	35	13		8, 733	66	24		25, 226
Ferricyanide (red prussiate)	42. 0	(2)	(2)		158				
All other	50. 0	38	19		21, 085	30	15		21, 456
Total chemical		5, 433	1, 444	33. 1	1, 784, 671	419	104	. 6	155, 834
Grand total		21, 328	4, 359	100. 0	2, 203, 458	45, 428	17, 109	100. 0	1, 442, 856

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[1] Chiefly wood ashes from Canada.
[2] Less than 1 ton.

Potash materials imported for consumption in the United States, 1942–43, by countries, in short tons

[Figures in parentheses in column headings indicate, in percent, approximate equivalent as potash (K_2O)]

Country	Muriate (chloride) (56.4)	Bitartrate		Potassium-sodium nitrate mixtures, crude (14)	Chlorate and perchlorate (36)	All other [1]	Total	
		Argols or wine lees (20)	Cream of tartar (25)				Short tons	Value
1942								
Algeria		1,403					1,403	$830,716
Argentina		1,042					1,042	195,521
Brazil		247					247	156,435
Canada	7	29			2	63	101	18,460
Chile		242		14,272		(2)	14,514	437,475
Mexico		22					22	1,471
Morocco (French)		626					626	224,382
Netherlands						1	1	335
Peru		3					3	1,491
Portugal		249					249	119,701
Spain		188					188	96,561
Switzerland					33		33	7,722
U. S. S. R.	1,557						1,557	39,816
United Kingdom [3]						1,342	1,342	73,372
	1,564	4,051		14,272	35	1,406	21,828	2,203,458
1943								
Argentina		183					183	65,622
Canada	(2)	2	4		55	33	94	28,931
Chile				19,767			19,767	580,760
China					(2)	(2)	(2)	405
Morocco (French)		79					79	22,850
Portugal		55					55	15,673
Switzerland					11		11	1,912
U. S. S. R.	25,212						25,212	705,599
United Kingdom [3]						27	27	21,104
	25,212	319	4	19,767	66	60	45,428	1,442,856

[1] Approximate equivalent as potash (K_2O)—1942: 47 percent; 1943: 55 percent.
[2] Less than 1 ton.
[3] United Kingdom of Great Britain and Northern Ireland.

Exports.—The total export trade in potash materials in 1943 was valued at over 7 million dollars. The total fertilizer potash materials exported in 1943—111,541 short tons, the largest quantity since 1939—had a value of a little more than 3 million dollars. The fertilizer exports went largely to Canada (74,698 tons) and the United Kingdom (26,591 tons). Exports of chemical potash totaled 20,133 tons in 1943 and had a value of nearly 4 million dollars. The principal potash chemicals exported were the hydroxide (caustic potash), the nitrate and mixtures, the chlorate and mixtures, and the bichromate and chromate. United Kingdom, U. S. S. R., and Canada, in the order named, were the leading recipients of exported domestic potash chemicals in 1943.

Potash materials exported from the United States, 1939–43

Year	Fertilizer		Chemical		Year	Fertilizer		Chemical	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1939	136,750	$4,446,853	3,579	$807,987	1942	84,402	$2,184,044	13,307	$3,611,656
1940	93,060	3,141,170	14,180	3,096,909	1943	111,541	3,168,446	20,133	3,950,542
1941	91,950	2,592,697	12,883	2,972,137					

Potash materials exported from the United States in 1943, by countries and classes, in short tons

Country	Fertilizers				
	Chloride	Sulfate	Potassic fertilizer materials [1]	Other [2]	Total
Argentina	1	1			2
Australia	8	28			36
Barbados	1,414				1,414
Brazil	632	(3)		63	695
Canada	49,626	6,706	737	17,629	74,698
Colombia	95	841			936
Cuba	2,446	1,451		499	4,396
Iceland	220	40			260
Mexico	114	(3)		1,188	1,302
New Zealand	398	440			838
Union of South Africa	11	81			92
U. S. S. R		145			145
United Kingdom [4]	26,591				26,591
Venezuela	45	58			103
Other countries	12	21			33
Total: Short tons	81,613	9,812	737	19,379	111,541
Value	$2,534,623	$401,455	$12,016	$220,352	$3,168,446

Country	Chemicals							
	Potassium iodides	Bichromate and chromate	Hydroxide (caustic potash)	Acetate and mixtures	Bicarbonate and mixtures	Carbonate and mixtures	Bitartrate and mixtures	Chlorate and mixtures
Argentina	1	38	101	(3)	1	1		(3)
Australia	3	(3)	204		1	70		30
Brazil	4	157	134	(3)	1	44	(3)	117
Canada	2	111	1,373	(3)	7	277	93	2
Chile	(3)	67	24	(3)	(3)	2	2	38
Colombia	13	73	17	(3)	(3)	32	7	32
Cuba	2	2	4	(3)	(3)	3	11	83
Egypt	(3)	8	1			2	1	131
Iceland	(3)	1	17			12	2	
India and Dependencies	(3)	(3)	26			(3)	1	110
Mexico	2	50	64	1	2	72	16	449
New Zealand	1	46	127	(3)	1	13	(3)	21
Union of South Africa	4	3	94	1	1	47	(3)	18
U. S. S. R		410	11			168		789
United Kingdom [4]			7,212					
Uruguay	1	36	29	(3)	(3)	4	(3)	1
Venezuela	4	6	21	(3)	1		9	3
Other countries	16	173	355			49	24	118
Total: Short tons	53	1,181	9,814	2	15	796	166	1,942
Value	$158,153	$259,500	$1,231,457	$1,687	$5,420	$120,021	$204,812	$609,428

See footnotes at end of table.

Potash materials exported from the United States in 1943, by countries and classes, in short tons—Continued

Country	Chemicals—Continued							
	Chromium sulfate (chrome alum)	Cyanide and mixtures	Nitrate and mixtures	Perchlorate and mixtures	Permanganate and mixtures	Rochelle salts	Other	Total
Argentina	....	13	1	....	7	(3)	14	177
Australia	5	10	....	....	6	....	8	337
Brazil	5	16	1,002	(3)	15	(3)	23	1,518
Canada	8	6	914	(3)	28	73	385	3,279
Chile	39	8	(3)	(3)	1	(3)	154	335
Colombia	31	11	147	....	4	4	2	373
Cuba	(3)	3	12	(3)	2	13	7	142
Egypt	1	9	(3)	....	1	(3)	1	155
Iceland	....	(3)	3	....	(3)	(3)	1	36
India and Dependencies	....	34	(3)	....	3	3	14	191
Mexico	1	7	322	....	10	11	51	1,058
New Zealand	....	....	19	....	3	2	120	353
Union of South Africa	(3)	1	21	....	1	2	128	321
U. S. S. R	75	....	1,520	....	23	....	333	3,329
United Kingdom [4]	....	....	....	....	....	1	....	7,213
Uruguay	....	(3)	1	....	1	(3)	5	78
Venezuela	1	1	59	....	2	2	4	113
Other countries	23	6	79	....	13	7	262	1,125
Total: Short tons	189	125	4,100	(3)	120	118	1,512	20,133
Value	$57,631	$69,562	$587,421	$84	$67,472	$100,027	$477,867	$3,950,542

[1] Containing 27 percent or more potassium oxide (K_2O) equivalent, n. e. s. (25 percent K_2O-content equivalent basis).
[2] 25 percent K_2O-content equivalent basis.
[3] Less than 1 ton.
[4] United Kingdom of Great Britain and Northern Ireland.

Potash materials exported from the United States, 1942–43, by countries

Country	Fertilizers				Chemicals			
	1942		1943		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	269	$12,974	2	$406	1,030	$256,420	177	$49,492
Australia	28	7,532	36	8,063	1,498	289,798	337	83,152
Barbados	1,331	59,793	1,414	62,441	(1)	78	....	....
Brazil	225	12,069	695	31,293	1,277	309,659	1,518	287,206
Canada	76,162	1,838,819	74,698	1,907,758	3,320	627,618	3,279	593,802
Chile	1	60	(1)	12	234	101,540	335	98,976
Colombia	544	38,066	936	37,268	208	106,012	373	144,036
Cuba	5,311	158,486	4,396	147,609	141	98,938	142	71,716
Egypt	....	....	....	....	285	107,942	155	58,786
Iceland	1	99	260	8,573	105	21,282	36	9,195
India and Dependencies	....	....	(1)	12	732	318,093	191	84,818
Mexico	177	3,957	1,302	15,043	1,218	494,048	1,058	283,356
New Zealand	(1)	1	838	40,430	116	50,498	353	57,384
Union of South Africa	23	1,686	92	5,572	154	69,487	321	112,732
U. S. S. R	157	42,112	145	40,496	1,113	186,096	3,329	664,222
United Kingdom [2]	....	....	26,591	853,846	1,095	205,879	7,213	875,786
Uruguay	2	570	....	....	101	30,256	78	18,494
Venezuela	(1)	21	103	5,581	106	48,277	113	52,639
Other countries	171	7,799	33	4,043	574	289,735	1,125	404,750
	84,402	2,184,044	111,541	3,168,446	13,307	3,611,656	20,133	3,950,542

[1] Less than 1 ton.
[2] United Kingdom of Great Britain and Northern Ireland.

WORLD PRODUCTION

Four nations continue to dominate world potash trade—Germany, United States, U. S. S. R., and Spain. Germany, the dominant producer of western Europe as well as of the world, retains the French and Polish potash industries, although early in 1944 the advancing Russian armies threatened its control of the potash deposits of Poland; it still holds all the important potash deposits of western Europe except those of Spain. Soviet Russia, with its large reserves in the Solikamsk region, controls the potash industry of eastern Europe. The United States is by far the largest potash producer in the Western Hemisphere; it is probably the second-largest producer in the world. Transportation along two of the potash trade routes—the Mediterranean and the Atlantic route from Murmansk—was eased for Allied movements by war developments.

World production of potash minerals and equivalent K_2O, 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country and mineral [1]	1938		1939		1940		1941		1942		1943	
	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O
North America: United States, potassium salts	485,291	287,532	496,007	283,223	597,150	344,437	894,895	476,156	1,149,810	616,162	1,296,215	670,534
South America: Chile, crude potassium nitrate	(2)	(2)	(2)	(2)	62,208	8,585	(2)	(2)	(2)	(2)	(2)	(2)
Europe:												
France (Alsace), crude potassium salts	3,374,811	581,790	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Germany, crude potassium salts:												
Carnallite [3]	1,874,375	1,861,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Kainite, sylvinite, and hartsalz	14,567,896											
Italy, alunite	2,778	333	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Poland, crude potassium salts:												
Kainite	120,100	12,010	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Sylvite	427,200	93,984	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Langbeinite	19,644	2,358	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain, crude potassium salts	[4] 49,572	(2)	[4] 143,393	(2)	[4] 291,373	(2)	[4] 314,938	[5] 117,000	(2)	[5] 89,000	(2)	[5] 87,000
U. S. S. R., crude potassium salts	(2)	[6] 122,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Asia:												
China, potash	[7] 14	(2)	[7] 4	(2)	3,317	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Chosen, alunite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
India (British), nitrate of potash	[6] 8,200	[6] 4,000	8,697	4,175	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Palestine, crude potassium salts [8]	58,118	29,059	[9] 63,527	31,764	88,961	(2)	101,681	(2)	(2)	(2)	(2)	(2)
Africa: Eritrea, niccoli salts [10]	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Australia, alunite	445	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed Iran is reported to produce a small quantity of potash salts, but statistics of production are not available.
[2] Data not available.
[3] Includes some natural kieserite.
[4] Salable.
[5] Unofficial.
[6] Estimated production (Imperial Institute, London).
[7] Exports of potassium carbonate.
[8] Extracted from waters of Dead Sea.
[9] Exports.
[10] Extracted from waters of Red Sea.

MICA

By G. Richards Gwinn and K. G. Warner

SUMMARY OUTLINE

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SUMMARY

Production of all kinds of mica and consumption of splittings and built-up mica reached an all-time high in 1943 as the industry expanded to meet the requirements of the armed services. Domestic production in 1943 supplied 11 percent of all receipts of good-stained and better compared with 10 percent for 1942. Although the percentage increase is small, the quantity produced is large because the total supply was much greater in 1943 than in the previous year.

India and Madagascar remain the chief producers, respectively, of muscovite and phlogopite splittings. Minor quantities of muscovite splittings were produced mechanically in the United States, and phlogopite splittings were also received from Canada and Mexico. A shortage of No. 5 or larger book-form muscovite splittings developed near the end of 1943 because of reduced production in India and restricted shipping space therefrom.

Since December 1942 the Metals Reserve Co., a subsidiary of the Reconstruction Finance Corporation, through its agent, the Colonial Mica Corporation, has been designated the sole purchaser of all strategic-grade domestic and imported Canadian mica. The mica section of the War Production Board allocates this mica to consumers, who make their purchases from the Colonial Mica Corporation. Much has been accomplished by these agencies. The number of mines operating at the end of 1943 was approximately 635 compared with 300 at the beginning of the year. Production has been increased, substitution of larger amounts of stained for clear mica has been made, and satisfactory electrical equipment to test the power factor and the presence of conducting veins or spots in mica was developed to supplement visual tests. A critical review of accomplishments has been presented in the Truman Committee Report.[1]

The accompanying table of salient statistics gives a summary of domestic production and consumption of mica during the past 5 years.

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[1] U. S. Senate, Special Committee to Investigate the National Defense Program: Rept. 10, part 16, 1944, pp. 84-90.

Salient statistics of the mica industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Domestic mica sold or used by producers:					
Total uncut sheet and punch:					
Pounds	813, 708	1, 625, 437	2, 666, 453	2, 761, 844	3, 448, 199
Value	$138, 963	$291, 685	$566, 858	$725, 030	$3, 228, 742
Average per pound	$0. 17	$0. 18	$0. 21	$0. 26	$0. 94
Scrap: [1]					
Short tons	24, 672	22, 386	32, 500	43, 262	46, 138
Value	$311, 895	$314, 565	$442, 789	$671, 165	$738, 025
Average per ton	$12. 64	$14. 05	$13. 62	$15. 51	$16. 00
Total sheet and scrap: [1]					
Short tons	25, 079	23, 199	33, 833	44, 643	47, 862
Value	$450, 858	$606, 250	$1, 009, 647	$1, 396, 195	$3, 966, 767
Total ground: [1]					
Short tons	30, 924	27, 984	43, 419	46, 979	51, 582
Value	$1, 156, 333	$1, 016, 628	$1, 532, 351	$1, 653, 358	$1, 990, 144
Consumption of splittings:					
Pounds	3, 423, 044	4, 918, 861	7, 297, 628	6, 636, 639	8, 331, 661
Value	$1, 089, 683	$1, 725, 522	$2, 832, 939	$2, 835, 421	$3, 461, 457
Imports for consumption:					
Total uncut sheet and punch:					
Pounds	902, 598	1, 534, 188	2, 016, 852	3, 244, 857	5, 501, 745
Value	$271, 072	$576, 565	$1, 119, 584	$2, 141, 465	$6, 313, 900
Scrap:					
Short tons	4, 279	3, 061	1, 251	2, 179	2, 048
Value	$29, 493	$22, 611	$12, 791	$25, 879	$27, 102
Total sheet and scrap:					
Short tons	4, 730	3, 828	2, 259	3, 801	4, 799
Value	$300, 565	$599, 176	$1, 132, 375	$2, 167, 344	$6, 341, 002
Manufactured:					
Short tons	1, 550	3, 860	6, 041	7, 493	8, 960
Value	$758, 745	$1, 884, 952	$3, 282, 656	$6, 860, 434	$8, 513, 064
Total imports:					
Short tons	6, 280	7, 688	8, 300	11, 294	13, 759
Value	$1, 059, 310	$2, 484, 128	$4, 415, 031	$9, 027, 778	$14, 854, 066
Exports (all classes of mica):					
Short tons	1, 827	903	1, 163	1, 001	693
Value	$226, 364	$191, 550	$280, 810	$303, 526	$653, 889

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[1] Includes mica recovered from kaolin and mica schists, as follows: 1939, 10,011 tons, $108,899; 1940, 9,674 tons, $138,148; 1941, 15,583 tons, $185,486; 1942, 20,481 tons, $315,807; 1943, 24,113 tons, $314,851.

DOMESTIC PRODUCTION

Sheet mica.—Production reached an all-time high in 1943—3,448,199 pounds valued at $3,228,742 compared with 2,761,844 pounds valued at $725,030 in 1942. Punch mica supplied 78 percent of this total or 2,691,083 pounds valued at $473,955; an increase over the 2,425,645 pounds of punch valued at $282,900 produced in 1942 but a decrease in percentage, as punch represented 88 percent of the total sheet produced in that year.

North Carolina remained the largest producer in the United States, supplying 57 percent of the total punch and 47 percent of the larger sheet in 1943. This is a decrease in percentage compared with 1942, when North Carolina furnished 60 and 61 percent, respectively, of the total output of punch and sheet mica; it is attributed to increased production in other States, notably New Hampshire, Georgia, Maine, and Idaho.

South Dakota was the third largest producer of mica; and although the quantity produced in 1943 declined from the 1942 total, the quality increased considerably. Georgia ranked fourth in 1943, displacing Connecticut. Before 1943 the production of mica in Georgia had been so small that the figures were not recorded separately. Maine attained sixth place, and substantial quantities were also received from Alabama, New Mexico, Idaho, Massachusetts, and Virginia.

Mica sold or used by producers in the United States, 1935–43

Year	Sheet mica						Scrap mica and mica recovered from kaolin and schists		Total	
	Uncut punch and circle mica [1]		Uncut mica larger than punch and circle		Total uncut sheet mica					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
1935–39 (average)	888,313	$46,408	252,411	$139,306	1,140,724	$185,714	21,986	$285,512	22,557	$471,226
1937	1,312,900	70,493	381,638	214,751	1,694.538	285,244	25,196	354,737	26,043	639,981
1938	774,121	45,566	165,386	93,767	939,507	139,333	20,257	256,382	20,727	395,715
1939	665,755	39,207	147,953	99,756	813,708	138,963	24,672	311,895	25,079	450,858
1940	1,405,305	116,087	220,132	175,598	1,625,437	291,685	22.386	314,565	23,199	606,250
1941	2,342,237	206,947	324,216	359,911	2,666,453	566,858	32.500	442,789	33,833	1,009,647
1942:										
Connecticut	196,377	14,231	25,106	16,570	221,483	30,801	200	4,443	311	35,244
New Hampshire	290,288	26,320	52,651	31,675	342,939	57,995	303	7,234	474	65,229
North Carolina	1,451,340	180,904	203,555	324,730	1,654,895	505,634	24,145	485,560	24,972	991,194
South Dakota	363,909	39,845	35,315	35,842	399,224	75,687	2,545	44,579	2,745	120,266
Other States [2]	123,731	21,600	19,572	33,313	143,303	54,913	16,069	129,349	16,141	184,262
	2,425,645	282,900	336,199	442,130	2,761,844	725,030	43,262	671,165	44,643	1,396,195
1943:										
Connecticut	165,186	26,528	36,956	38,711	202,142	65,239	304	6,795	405	72.034
Georgia	175,228	41,390	37,326	154,432	212,554	195.822	6,251	39,336	6,357	235,158
New Hampshire	491,879	171,705	208,664	411,838	700,543	583,543	1,148	28,643	1,498	612,186
North Carolina	1,543,016	159,535	358,104	1,612,789	1,901,120	1,772,324	25,295	516,367	26,246	2,288,691
South Dakota	248,489	52,674	84,935	394,535	333,424	447,209	2,234	42,764	2,401	489,973
Other States [2]	67,285	22,123	31,131	142,482	98,416	164,605	10,906	104,120	10,955	268,725
	2,691,083	473,955	757,116	2,754,787	3,448,199	3,228,742	46,138	738,025	47,862	3,966,767

[1] Includes small quantities of splittings in certain years.

[2] 1942: Alabama, California, Colorado, Georgia, Idaho, Maine, Massachusetts, New Mexico, South Carolina, Texas, Vermont, and Virginia. 1943: Alabama, Arizona, California, Colorado, Idaho, Maine, Maryland, Massachusetts, Montana, Nevada, New Mexico, Pennsylvania, South Carolina, Texas, Virginia, and Wyoming.

The increase in the quantity and value of sheet mica produced in 1943 and the decrease in the percentage of punch compared with the previous year may be attributed largely to the Government program of paying premium prices for three-quarter and full-trim mica. Monthly statistics of purchases of clear and stained mica were first collected by the Bureau of Mines in 1941 and may be used as an index of production, as it is impractical to canvass the multitude of small producers upon a monthly basis. Some divergence may be expected because of variations in stocks held by producers. The average monthly purchases of clear and stained mica, by quarters, for 1942 and 1943 are shown in figure 1.

The large increase in the production of stained mica in 1943 is attributed to the War Production Board program of substituting larger quantities of lower-grade material for clear mica wherever possible.

Scrap mica.—Production of scrap mica in 1943 increased to 46,138 short tons valued at $738,025 compared with 43,262 tons valued at $671,165 in 1942. In addition to mine scrap, these figures include 24,113 tons valued at $314,851, obtained from washing kaolin and by milling mica schists. Comparable figures for 1942 were 20,481 tons valued at $315,807.

Ground mica.—Production of ground mica in 1943 reached an all-time high of 51,582 short tons valued at $1,990,144 compared with 46,979 tons valued at $1,653,358 in 1942.

Present uses reflect the heavy demands for military applications and the weaker market in normal peacetime industry. Thus sales of ground mica used in paints for waterproofing tents and tarpaulins, in plastics, rubber, and welding-rod coatings increased, but those of dry-ground mica for roofing and wet-ground material used in wallpaper decreased. For pipe-line enamel use, fine, dry-ground mica is mixed

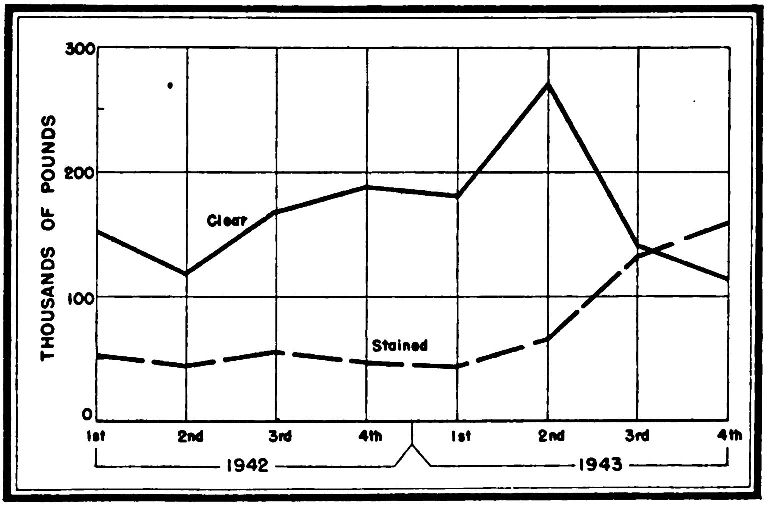

FIGURE 1.—Average monthly purchases of domestic sheet mica, clear and stained, for each quarter, 1942–43.

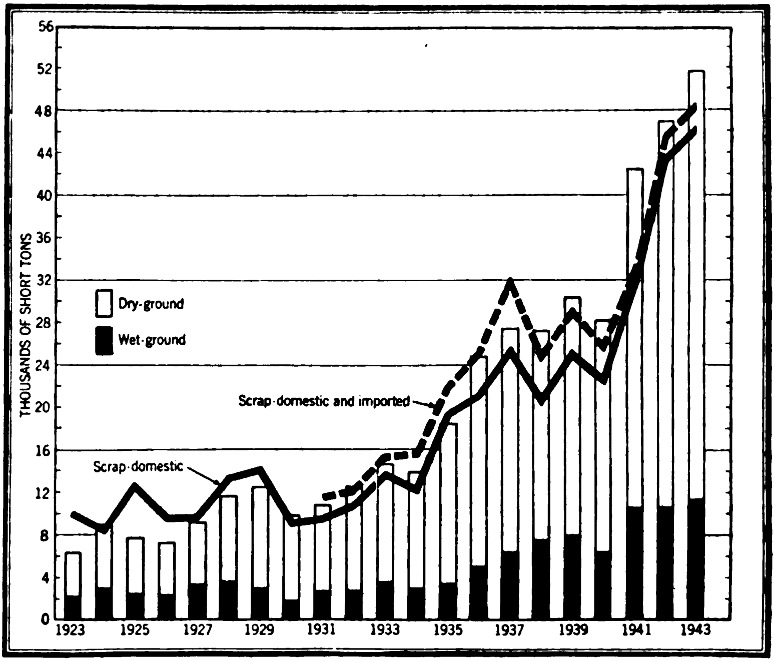

FIGURE 2.—Scrap and ground mica sold in the United States, 1923–43.

with a tar base. The flat mica plates serve as a binder in the enamel as well as an insulation medium.

The history of the scrap- and ground-mica industries over a series of years is indicated in figure 2.

Ground mica (including mica from kaolin and schists) sold by producers in the United States, 1939–43, by methods of grinding

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	23,222	$547,539	7,702	$608,794	30,924	$1,156,333
1940	21,809	515,930	6,175	500,698	27,984	1,016,628
1941	31,914	733,559	11,505	798,792	43,419	1,582,351
1942	36,369	805,163	10,610	848,195	46,979	1,653,358
1943	40,256	1,027,781	11,326	962,363	51,582	1,990,144

Ground mica (including mica from kaolin and schists) sold by producers in the United States to various industries, 1942–43

Industry	1942			1943		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Roofing	28,342	60	$561,205	29,022	56	$682,970
Wallpaper	2,168	5	168,178	1,814	3	158,937
Rubber	1,754	4	115,563	3,063	6	175,922
Paint	6,819	14	418,548	7,608	15	431,832
Plastics	1,868	4	125,449	2,969	6	203,699
Miscellaneous [1]	6,028	13	264,415	7,106	14	341,784
	46,979	100	1,653,358	51,582	100	1,990,144

[1] Includes mica used for molded electric insulation, house insulation, Christmas-tree snow, manufacture of axle greases and oil, annealing, pipe-line enamel, textiles, oil-well drilling, welding, and other purposes

TOTAL CONSUMPTION OF BLOCK AND SHEET MICA

Uses of the various grades of strategic mica in 1943 changed materially from the previous year. Radio, radar, and magneto condensers consumed more high-quality mica than the total military requirements for mica in the first half of 1942. Conservation and substitution programs developed in the laboratories of the armed services and the radio manufacturers made possible during the year the use of increasing amounts of stained mica in radio tubes, spark plugs, and applications where its function is primarily insulation and protection against flash-over rather than capacitance and high dielectric strength. Paper, ceramic products, and newly developed dielectric materials also proved satisfactory substitutes for some of the uses in which high-quality condenser-grade mica had previously been specified.

Figure 3 summarizes graphically the situation with respect to imports and domestic production. As reported by the Mica-Graphite Division of the War Production Board, approximately 94 percent of the total quantity of "good-stained and better" grades was used in military radio condensers and magnetos, and 93 percent of that classed as "stained" was used in radio tubes, condensers, and spark plugs. Stocks of the strategic grades on hand December 31, 1943, were adequate for 15 months' supply at the average rate of consumption during 1943. A break-down by sizes and grades shows that the supply of individual sizes ranges from 3 to 8 months for No. 5½ to 8 to 20 months for No. 6.

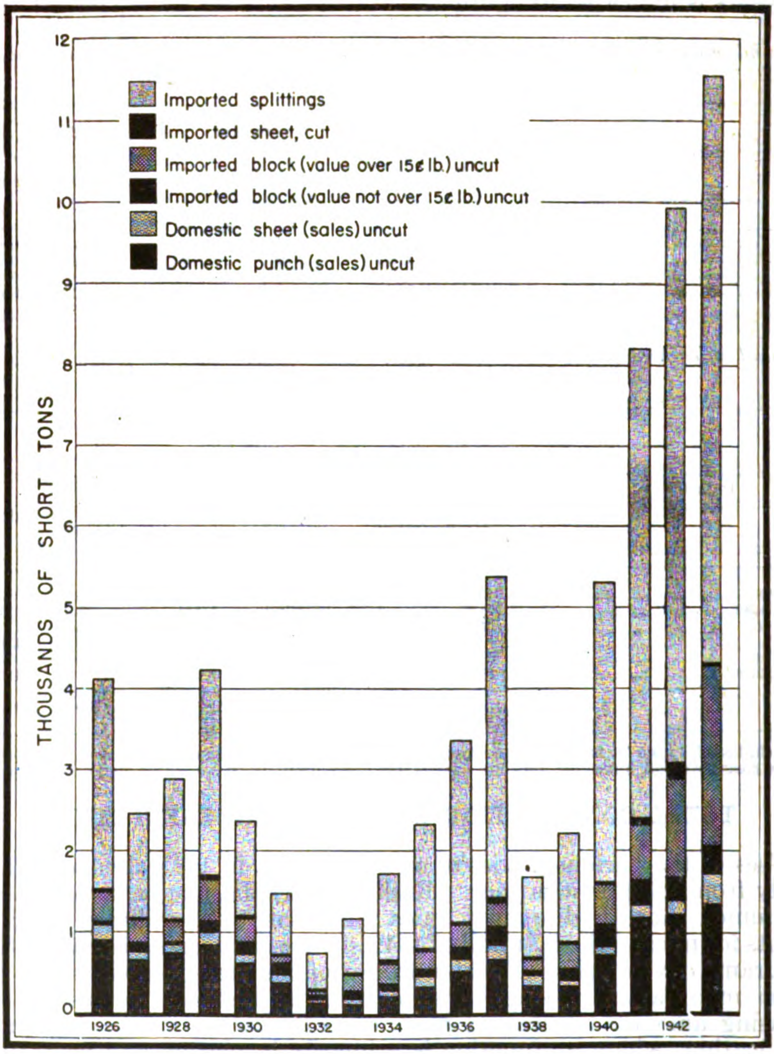

Figure 3.—Block and sheet mica (cut) and splittings imported for consumption in the United States and sales of domestic sheet and punch mica, 1926–43.

MICA SPLITTINGS

Consumption of splittings reached an all-time high in 1943; and, although Government stocks increased from 11,338,000 pounds on January 1, 1943, to 17,182,000 pounds by the end of the year, industry stocks decreased. A shortage developed in the supply of No. 5 or larger book-form muscovite splittings (which are used largely in the manufacture of tape for armature insulation in high-voltage generators, industrial motors and small transformers), and they were put under allocation control by the War Production Board in Order M 101–a, effective March 15, 1944. Consumption of muscovite splittings alone increased in each quarter. Amber splittings declined in the second quarter and then increased through the third and fourth quarters to a new high by the end of the year.

Grade 6 loose splittings—first-, second-, and third-quality—in 1943, as in the previous year, constituted 81 percent of the total consumption of muscovite splittings. Nearly equal amounts of first- and third-quality splittings were consumed, but consumption of No. 2 quality was greater than that of Nos. 1 and 3.

Consumption and stocks of mica splittings in the United States, 1939–43, by sources, as reported by the consumers

Year	India		Canada		Madagascar		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Consumption:								
1939	2,995,626	$905,763	107,101	$44,065	320,317	$139,855	3,423,044	$1,089,683
1940	4,252,120	1,358,534	54,044	28,491	612,697	338,497	4,918,861	1,725,522
1941	6,473,459	2,334,432	179,783	131,350	644,386	367,157	7,297,628	2,832,939
1942	5,998,614	2,415,709	117,295	79,752	520,730	339,960	6,636,639	2,835,421
1943	7,649,596	3,054,995	344,966	172,674	337,099	233,788	8,331,661	3,461,457
Stocks in consumers' hands Dec. 31:								
1939	2,754,748	857,656	52,523	17,697	673,354	273,465	3,480,625	1,148,818
1940	4,620,934	1,776,974	53,378	35,581	738,489	410,068	5,412,801	2,222,623
1941	9,212,891	3,434,336	115,529	81,988	223,235	134,143	9,551,655	3,650,467
1942	8,202,240	3,367,788	257,591	178,082	321,529	201,274	8,781,360	3,747,144
1943	4,031,849	1,708,096	138,564	85,893	215,639	139,797	4,386,052	1,933,786

The phlogopite splittings manufactured in the Western Hemisphere in 1943 and imported by the United States came from material mined in Canada and Mexico. Mexican splittings were hand-split, but the Canadian splittings consisted of hand- and machine-split material. Splittings manufactured domestically consisted of machine-split phlogopite from Canada.

India is the sole large-scale producer of muscovite splittings, owing to its large supplies of mica and the necessary low-wage labor. Some block mica produced in Brazil is shipped to India for splitting.

The 1943 supply, except for No. 5 book-form muscovite splittings, was more than enough to meet requirements for the year. Consumption of splittings from July 1942 through December 1943 is summarized graphically upon a quarterly basis in figure 4.

BUILT-UP MICA

The consumption of all types of built-up mica products in 1943 increased 11 percent over the 1942 figures and reached an all-time high as the requirements of the armed services for commutator segments and V-rings for use in generators and starters and tape for armature insulation in high-voltage generators, industrial motors, and small transformers continued to increase. Increases of particular types ranged from 5 percent for "all other (tape, etc.)" to 17 percent for segment plate. Splittings used for built-up mica are mainly muscovite, but some phlogopite (amber) splittings are used in commutator segments in flush-type commutators.

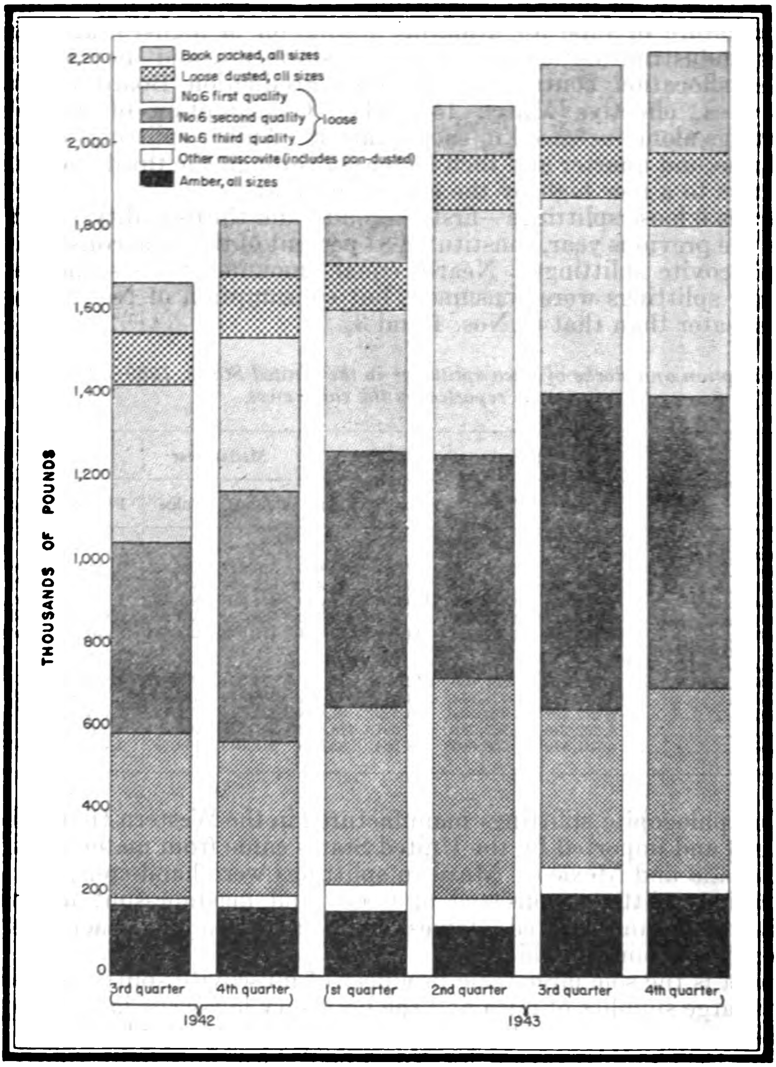

FIGURE 4.—Consumption of specified sizes and qualities of mica splittings in the United States, by quarters, July 1942 to December 1943.

Built-up mica produced in the United States, 1942–43, by kind of product[1]

Product	1942		1943	
	Pounds	Value	Pounds	Value
Molding plate	1,599,000	$1,552,000	1,785,000	$1,912,000
Segment plate	2,045,000	2,367,000	2,388,000	2,846,000
Heater plate	212,000	303,000	235,000	462,000
Flexible (cold)	649,000	743,000	707,000	831,000
All other (tape, etc.)	1,628,000	2,794,000	1,716,000	3,222,000
	6,133,000	7,759,000	6,831,000	9,273,000

[1] Partly estimated.

PRICES

The requirements of the armed services for the smaller sizes of strategic mica increased greatly in 1943. After a careful study of requirements, prices, mine production, and costs, a new buying schedule that provided a substantially higher price to domestic miners for the smaller sizes and punch mica was released by the Colonial Mica Corporation on May 24, 1943, effective to December 31, 1943. The new schedule offers a fixed price for all sizes of sheet mica from 1½ to 2 inches and up of $5 per pound, provided the mica is three-quarter trim or better. Two alternatives are offered for the sale of punch mica:

(1) As punch mica, having a usable area less than 1½ by 2 inches, at a base price of 40 cents per pound.

(2) Sizes 1 by 1 inch up to 1½ by 2 inches full trim, $5 per pound for either No. 1 or No. 2 quality. On December 7, 1943, the effective date of this schedule was continued to June 30, 1944, and on January 28, 1944, it was further extended to December 31, 1944, and a bonus of $1 per pound was offered for all domestic strategic mica delivered to the purchasing shops of the Colonial Mica Corporation on or before June 30, 1944. Later this bonus also was extended to December 31, 1944.

The average selling price of the domestic mica sold to fabricators by the Colonial Mica Corporation is approximately $1.50 per pound, which is also the approximate average selling price of imported mica. The average cost of all the imported mica obtained by the Metals Reserve Co., however, is less than $1 per pound.

There is also a critical need for domestic nonstrategic sheet and scrap mica, which is produced at the same mines as the strategic material and in much larger quantity. However, although strategic grades were excepted from price control under Supplementary Regulation 1 to the General Maximum Price Regulation, the prices for nonstrategic grades were frozen at the March 1942 level. As the production costs of both grades are virtually the same, the effect was to restrict output of the lower-grade material. Therefore on March 26, 1943, the Office of Price Administration, under Order M. P. R. 347, removed nonstrategic punch, sheet and scrap mica and crude mica schist from price control. The maximum price of domestic ground mica, mica schist, water-washed mica, and micronized mica was raised $5 per ton for all producers except David T. Vance of Plumtree, N. C., and the Newdale Mica Co. of Erwin, Tenn., who were allowed an advance of $10 per ton. On June 21, 1943, under Amendment 2 to M. P. R. 347, a ceiling of $25 per ton was placed on scrap, byproduct scrap, jig scrap, or other scrap produced in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, or New York, f. o. b. mine or rifting shop.

Trade-journal quotations and average sales value of domestic uncut sheet mica per pound in 1943

Size	Trade-journal quotations [1]		Average value [2]	
	Clear	Black-stained	Clear	Stained
Punch	$0.30	$0.12	$0.233	$0.064
1 by 1 inch			1.213	.368
1¼ by 1¼ inches			2.112	.595
1 by 1½ inches			1.207	1.800
1½ by 1½ inches			3.160	
1½ by 2 inches	2.40	.25	2.575	.971
2 by 2 inches	3.52	.45	3.815	1.028
2 by 3 inches	4.64	.60	5.075	1.321
3 by 3 inches	5.12	.75	5.678	1.540
3 by 4 inches	6.08	1.00	6.772	1.764
3 by 5 inches	7.04	1.30	7.963	2.330
4 by 6 inches	8.00	1.60	9.061	2.125
6 by 8 inches	9.12	2.00	10.225	3.707
8 by 10 inches			8.500	3.667

[1] E&MJ Metal and Mineral Markets quotations for minimum half trim.
[2] Calculated from reports of sales by domestic producers to the Bureau of Mines.

POST-WAR OUTLOOK

The post-war problems of the domestic mica industry will be chiefly economic. Production statistics for 1942 and 1943 show that domestic mica mines can produce, on the average, as high a percentage of good-stained and better grades of mica as either Indian or Brazilian mines, but trimming costs alone—disregarding mining costs—exceed the cost of importing Indian or Brazilian material tariff included.

The two mica-testing instruments developed by the Bell Telephone Laboratories to measure dielectric quality (power factor) and to indicate the presence of conducting mineral inclusions or pinholes have made possible the use of large quantities of stained material for condenser purposes. However, the domestic industry will not benefit appreciably from the use of this equipment until the large stocks of imported stained material on hand have been consumed.

The premium price of $6 per pound now paid by the Colonial Mica Corporation is established only for the duration of the war, unless favorable action is taken on the proposal made by the War Production Board to continue this price for the additional time thereafter required to create a Government stock pile sufficient for 3 years. Peacetime costs of producing sheet mica in the United States are estimated at approximately $3 per pound compared with $1.11 and 92 cents per pound for Indian and Brazilian mica, respectively, of comparable grade. It does not seem probable therefore that the post-war markets for domestic mica will be larger than during the years immediately preceding the war.

FOREIGN TRADE[2]

Imports.—In 1943 imports of all kinds of mica totaled 13,759 short tons valued at $14,854,066 compared with 11,294 tons valued at $9,027,778 in 1942. Imports of block mica, films, and splittings increased, but those of ground mica decreased; no imports were received of manufactured products in which mica is the component of chief value.

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[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

The increased value of imports in 1943 may be attributed mainly to the larger quantities of higher-grade sheet mica and the larger sizes of films and splittings received. Large-size films and splittings are valued at $1 to $1.25 per pound compared with 65 cents per pound for the smaller sizes. Another factor was that the greater part of the ground or pulverized mica imported was wet-ground material valued at $30 to $60 per ton compared with $16 per ton for the dry-ground material received in 1942. Further details on imports, by kinds and sources of origin, may be found in the following tables.

Mica imported for consumption in the United States in 1943, by kinds and by countries

Country	Unmanufactured									
	Waste and scrap, valued not more than 5 cents per pound				Untrimmed phlogopite mica from which no rectangular piece exceeding in size 1 inch by 2 inches may be cut (duty, 10 percent)		Other			
	Phlogopite (duty, 15 percent)		Other (duty, 25 percent)				Valued not above 15 cents per pound n. e. s. (duty, 4 cents per pound)		Valued above 15 cents per pound (duty, 4 cents per pound + 25 percent)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:										
British East Africa									1, 615	$5, 576
Gold Coast									1, 588	4, 129
Madagascar									108, 766	87, 683
Argentina							155, 511	$21, 197	577, 035	479, 699
Bolivia							40	4	913	360
Brazil							316, 931	34, 508	1, 553, 331	2, 428, 347
Canada	3, 753, 620	$24, 216	343, 200	$2, 886	293, 555	$40, 392	297, 610	25, 043	86, 931	176, 197
Guatemala									8, 220	4, 968
India and Dependencies							300	45	2, 022, 721	2, 908, 081
Mexico									53, 998	79, 002
Peru									20, 507	9, 229
Portugal									2, 173	9, 440
Total: 1943	3, 753, 620	24, 216	343, 200	2, 886	293, 555	40, 392	770, 392	80, 797	4, 437, 798	6, 192, 711
1942	4, 357, 536	25, 879			232, 431	32, 799	595, 317	71, 900	2, 417, 109	2, 036, 766

Country	Manufactured—Films and splittings							
	Not cut or stamped to dimensions				Cut or stamped to dimensions (duty, 45 percent)		Total films and splittings	
	Not above 12 ten-thousandths of an inch in thickness (duty, 25 percent)		Over 12 ten-thousandths of an inch in thickness (duty, 40 percent)					
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:								
Madagascar	20, 229	$19, 523	110, 709	$110, 709			130, 938	$130, 232
Portuguese Guinea and Angola	5, 038	58					5, 038	58
Argentina			220	397			220	397
Brazil			309	249			309	249
Canada	40, 194	26, 331					40, 194	26, 331
India and Dependencies	14, 247, 964	3, 888, 081	2, 170, 228	3, 903, 030	20, 645	$40, 999	16, 438, 837	7, 832, 110
Japan			8, 960	2, 953			8, 960	2, 953
Mexico	197, 020	161, 238	79, 263	171, 480			276, 283	332, 718
Total: 1943	14, 510, 445	4, 095, 231	2, 369, 689	4, 188, 818	20, 645	40, 999	16, 900, 779	8, 325, 048
1942	11, 162, 083	3, 352, 823	1, 976, 125	1, 266, 313	511, 265	1, 332, 538	13, 649, 473	5, 951, 674

Mica imported for consumption in the United States in 1943, by kinds and by countries—Continued

Country	Manufactured—Cut or stamped to dimensions, shape, or form (duty, 40 percent)		Manufactured—Other					
			Mica plates and built-up mica (duty, 40 percent)		All manufactures of which mica is the component material of chief value (duty, 40 percent)		Ground or pulverized (duty, 15 percent)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa: British East Africa			439	$1,317				
Canada	7,686	$20,397					835,800	$18,994
India and Dependencies	43,121	38,341	110,055	66,502				
Spain			21,780	42,465				
Total: 1943	50,807	58,738	132,274	110,284			835,800	18,994
1942	388,988	893,197	10,174	6,511	2,685	$1,454	934,645	7,598

Exports.—Exports of both unmanufactured and manufactured mica were lower in 1943 than 1942. The unmanufactured mica exported to Mexico consists chiefly of Indian and Brazilian block mica reexported for manufacture into condenser splits, all of which are returned to the United States.

Mica and manufactures of mica exported from the United States in 1943, by countries

Country	Unmanufactured		Manufactured			
			Ground or pulverized		Other	
	Pounds	Value	Pounds	Value	Pounds	Value
North America:						
Bermuda					2,828	$2,029
Canada	17,949	$6,073	700,413	$27,717	118,418	294,550
Cuba			24,678	942	708	975
Mexico	87,220	36,936	17,160	864	14,907	6,557
Other North America	270	13			659	1,153
South America:						
Brazil			8,600	424	2,116	2,856
Chile	15	146	1,000	49	1,988	4,178
Colombia	21,600	597	500	28	389	480
Venezuela			4,700	199	4,825	635
Other South America			400	17	395	1,284
Europe:						
U. S. S. R.					68,913	44,924
United Kingdom [1]	29,585	103,120	144,000	5,805	23,446	84,619
Asia:						
China					100	3,190
India and Dependencies	22,000	639	56,300	1,307	103	242
Africa:						
Algeria					3,184	4,074
Union of South Africa					4,763	11,406
Other Africa					763	1,306
Oceania					1,686	4,555
Total: 1943	178,639	147,524	957,751	37,352	250,191	469,013
1942	400,268	4,270	1,445,058	50,710	156,914	248,546

[1] United Kingdom of Great Britain and Northern Ireland.

MICA AVAILABLE TO ENEMY COUNTRIES

Complete answers to the question of the quantity and quality of the mica available to the enemy countries cannot be given until after the war; however, some estimates may be made.

Their preparation for war began years before ours, and large stock piles were accumulated. Germany, Italy, and Japan imported heavily from India, Argentina, and Brazil. Exports of mica from India to Japan were not shut off until July 1941 and from Brazil and Argentina to Japan, Italy, and Germany until January 1942. A large part of the Japanese imports of mica was purchased for the account of Italy and Germany. Also from captured equipment it is known that their electronic program was designed with a mica shortage in mind.

The sources of supply of mica to Germany in 1943 and estimates of the quantity and quality available, as reported by the Foreign Economic Administration and consular reports, are as follows:

	Short tons	*Sheet mica, percent*
Rumania	551	4. 8
Norway	220	1. 2–4. 8
Bulgaria	220	2. 2–4. 8
Spain	167	100. 0
Macedonia	7	30. 0 70. 0 splittings

Little is known of the sources of mica now available to Japan. It seems probable, however, that except for domestic production, most of which is scrap, it controls only the mica in Chosen (Korea), the major part of which is phlogopite.[3] Japan bought all grades of mica from Argentina, Brazil, and India, in contrast with Germany and Italy, which purchased only sheet mica. The annual output of the Peruvian mimes—approximately 200 tons, the greater part of which was scrap—was also purchased by Japan until December 7, 1941.

WORLD PRODUCTION

Data on foreign production are not complete at this time, but reports from the major producing countries and some new sources show an increase in output of the better grades of muscovite and phlogopite mica. The following table presents available figures by countries from 1938 to 1943.

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[3] Chowdhury, R. R., Handbook of Mica: Chemical Publishing Co. Inc., Brooklyn, N. Y., 1941, p. 136.

World production of mica, 1938–43, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943
North America:						
Canada (sales)	470	969	819	1,582	2,731	(2)
Guatemala	----	----	----	----	[3] 3	5
Mexico	(2)	(2)	[3] 39	[3] 36	44	104
United States (sold or used by producers) [4]	18,803	22,751	21,046	30,693	40,499	43,419
South America:						
Argentina	[5] 250	[5] 298	[5] 442	540	625	423
Bolivia (exports)	4	----	1	3	3	2
Brazil (exports)	521	435	1,117	867	866	796
Peru	24	9	4	8	[3] 5	[3] 9
Europe:						
Italy	122	(2)	(2)	(2)	(2)	(2)
Norway (exports)	104	25	(2)	(2)	(2)	(2)
Rumania	22	18	(2)	(2)	(2)	(2)
Spain	----	----	20	215	(2)	[6] 600
Sweden	131	126	(2)	(2)	(2)	(2)
Asia:						
Ceylon (exports)	(7)	(7)	2	(2)	(2)	(2)
India, British (exports)	8,896	10,104	8,654	10,584	8,729	[6] 10,500
Africa:						
Madagascar	677	(2)	531	479	320	[8] 215
Nigeria	3	(2)	(2)	(2)	(2)	(2)
Portuguese East Africa	----	17	(2)	(2)	(2)	(2)
Rhodesia:						
Northern	4	2	2	(7)	(2)	(2)
Southern	13	6	6	9	14	30
Tanganyika Territory	37	36	10	(2)	(2)	(2)
Union of South Africa: Transvaal	1,116	972	1,252	1,076	1,315	[9] 986
Oceania:						
Australia	69	88	106	(2)	(2)	(2)
New Zealand	(2)	1	----	(2)	(2)	(2)

[1] In addition to the countries listed mica is also produced in Chosen, Colombia, Eritrea, Kenya, Portugal, and U. S. S. R., but data on production are not available.
[2] Data not available.
[3] Exports.
[4] Includes following quantities recovered from kaolin and schists: 1938, 5,942 tons; 1939, 9,082 tons; 1940, 8,776 tons; 1941, 14,137 tons; 1942, 18,580 tons; 1943, 21,875 tons.
[5] Rail and river shipments.
[6] Estimate.
[7] Less than 1 ton.
[8] July to December, inclusive.
[9] January to September, inclusive.

Argentina.—The Argentine became our third largest foreign source of strategic mica in 1943, providing 11 percent of our supply or an amount approximately equal to domestic production. All purchases from Argentina were for private account as no Government agency entered actively into either purchasing or mining.

Brazil.—The United States Purchasing Commission has been responsible for Brazilian mica production since July 1942, providing technical assistance, renting mining equipment, and operating some mines under contract with the owner. Under this stimulus Brazilian mica production increased and in 1943 accounted for approximately 18 percent of the United States supply of good-stained and better grades of mica.

Canada.—Production of sheet muscovite, phlogopite splittings, and ground mica continued to increase during 1943. Additional deposits of muscovite were opened in the Eau Claire district of Ontario.

India.—India maintained its place as the dominant world supplier of strategic mica in 1943. The threat of Japanese invasion eased, and the transport problem was solved by airborne shipments of strategic grades to the United States and the United Kingdom.

Madagascar.—Small shipments of phlogopite block and splittings were received from Madagascar in 1943, and larger quantities are expected in 1944, as production, aided by additional mining equipment, has increased.

SALT

By F. E. Harris and K. G. Warner

SUMMARY OUTLINE

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SUMMARY

The mines, wells, and ponds in the United States yielded 15,214,152 short tons of salt valued at $43,878,266 in 1943, representing increases of 11 percent in quantity and 15 percent in value over the 1942 totals. The unit value increased from $2.79 to $2.88. Of the 1943 output, brine increased 8 percent, rock salt 16, and evaporated salt 14 percent.

Increases were due primarily to war requirements of magnesium metal, synthetic rubber, and rubberlike materials, for which all classes of salt were used. Exports of salt increased 23 percent, chiefly in shipments to Newfoundland and Labrador, Canada, Mexico, and Greenland. Imports of salt (which decreased 84 percent) included no shipments of salt for curing fish, an unusual situation.

Salient statistics of the salt industry in the United States, 1935–39 (average) and 1940–43

	1935-39 (average)	1940	1941	1942	1943
Sold or used by producers:					
Manufactured (evaporated) short tons	2,507,374	2,782,741	3,330,106	3,517,832	3,993,899
In brine do	4,205,587	5,311,671	6,771,436	7,373,165	7,961,115
Rock salt do	1,947,254	2,265,548	2,619,087	2,802,287	3,259,138
Total:					
Short tons	8,660,215	10,359,960	12,720,629	13,693,284	15,214,152
Value [1]	$23,405,612	$26,474,619	$33,620,376	$38,144,234	$43,878,266
Average per ton [1]	$2.70	$2.56	$2.64	$2.79	$2.88
Imports for consumption:					
For curing fish short tons	[2] 21,250	[2] 12,965	7,426	[2] 6,434	----------
Value	[2] $43,722	[2] $25,174	$30,058	[2] $17,667	----------
In bags, barrels, etc short tons	1,385	1,024	1,110	367	129
Value	$11,813	$6,601	$12,156	$4,138	$2,425
In bulk short tons	24,131	16,413	6,896	953	1,129
Value	$55,876	$59,029	$17,021	$7,496	$10,325
Total:					
Short tons	46,766	30,402	15,432	7,754	1,258
Value	$111,411	$90,804	$59,235	$29,301	$12,750
Exports:					
Short tons	90,214	147,044	123,195	118,424	145,803
Value	$521,652	$699,340	$807,925	$892,160	$1,173,139
Apparent consumption [3] short tons	8,616,767	10,243,318	12,612,866	13,582,614	15,069,607

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[1] Values are f. o. b. mine or refinery and do not include cost of cooperage or containers.

[2] Includes salt in bags, sacks, barrels, or other packages—1938: 93 tons valued at $673; 1940: 6 tons, $12; 1942: 122 tons, $1,200.

[3] Quantity sold or used by producers plus imports minus exports.

The acute shortage of labor and the large turn-over hampered operations and reduced the output in many salt fields and plants. Some of the smaller companies closed for the duration of the war or until the labor situation improves. No strikes were reported. The only sections of the country reporting poor demand are those that serve small local markets chiefly with cattle salt and are unfavorably located with respect to markets and railroad facilities. Many sections experienced difficulty in moving the salt, as transportation facilities were lacking. Certain salt fields in the path of Army maneuvers were inactive in 1943. Two Defense Plant Corporation plants began producing salt in 1943. Several magnesium-metal manufacturers expanded operations, which increased salt requirements greatly, but as the new units were not in full operation until well into 1943 the entire increase is not yet reflected in totals reported.

The accompanying graph (fig. 1) is not comparable with corresponding charts in the Salt chapters of Minerals Yearbook, 1941, and previous years because the Federal Reserve Board index of industrial production has been revised. (See Federal Reserve Bulletin, October 1943, pp. 940–952.)

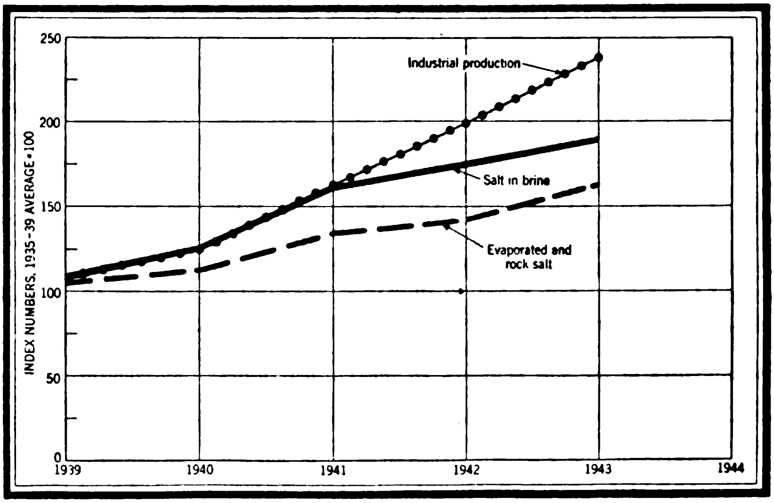

FIGURE 1.—Index of salt in brine and of evaporated and rock salt compared with industrial production, 1939–43. Index of industrial production from Federal Reserve Board.

PRODUCTION

Salt was produced by 57 companies in 83 plants operating in 13 States and Puerto Rico in 1943 compared with 64 companies operating 86 plants in 14 States and Puerto Rico in 1942.

Production of the three classes of salt is compared in the accompanying graph (fig. 2).

Production by States.—The order of magnitude of production of salt of all classes by the leading States was as follows: Michigan, New York, Ohio, Louisiana, Texas, Kansas, and California.

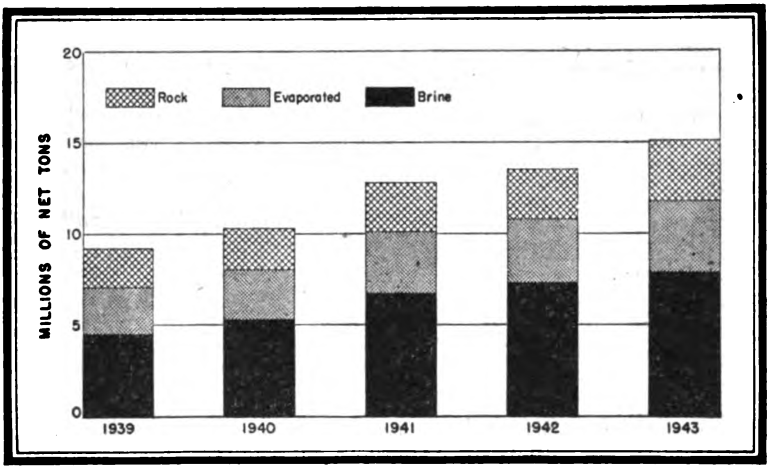

FIGURE 2.—Trends in the quantity of rock salt, evaporated salt, and brine (in terms of salt content) sold or used by producers in the United States, 1939–43.

Salt sold or used by producers in the United States, 1941–43, by States

State	1941			1942			1943		
	Quantity		Value	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total	
California	484, 632	4	$2, 290, 265	546, 320	4	$2, 494, 485	596, 015	4	$2, 839, 560
Kansas	781, 014	6	3, 254, 828	860, 083	6	3, 809, 321	945, 287	6	4, 197, 507
Louisiana	1, 242, 242	10	3, 251, 492	1, 332, 129	10	3, 381, 856	1, 620, 382	11	3, 678, 068
Michigan	3, 620, 649	29	10, 975, 872	3, 946, 591	29	12, 583, 964	4, 284, 685	28	14, 472, 820
New Mexico	16, 641	(1)	51, 514	13, 956	(1)	47, 265	10, 829	(1)	21, 427
New York	2, 719, 586	21	7, 416, 734	2, 722, 670	20	8, 158, 147	2, 926, 388	19	9, 328, 672
Ohio	2, 510, 096	20	3, 367, 544	2, 711, 188	20	3, 864, 588	2, 818, 928	19	3, 824, 508
Oklahoma	10, 743	(1)	42, 737	8, 305	(1)	35, 132	7, 716	(1)	30, 496
Puerto Rico	14, 444	(1)	72, 220	18, 198	(1)	103, 071	17, 505	(1)	109, 337
Texas	656, 569	5	1, 713, 508	821, 111	6	2, 202, 527	1, 127, 854	7	3, 610, 532
Utah	107, 079	1	196, 413	110, 871	1	290, 040	169, 810	1	562, 293
West Virginia	143, 780	1	792, 104	140, 216	1	822, 794	230, 329	2	923, 499
Other States [2]	413, 154	3	195, 145	461, 646	3	351, 044	458, 424	3	279, 547
	12, 720, 629	100	33, 620, 376	13, 693, 284	100	38, 144, 234	15, 214, 152	100	43, 878, 266

[1] Less than 0.5 percent.
[2] 1941: Colorado and Virginia; 1942: Colorado, Nevada, and Virginia; 1943: Nevada and Virginia.

All seven plants in Puerto Rico produced table salt. Demand on the island was good throughout 1943.. However, the producers were handicapped by the heavy rainfall during the production period and the hurricane of October 14, which lowered the output as a great deal of salt was dissolved, the ponds overflowed, and mud and other impurities were carried into the pans. It has been reported that sales since December 1943 were rationed because of the ensuing salt shortage.

Methods of manufacture.—Various methods of salt manufacture are employed, and the quantities made by each method are given in the accompanying table. The quantities produced in open pans and grainers are combined, including also a considerable quantity produced by the Alberger method.

Salt sold or used by producers in the United States, 1942–43, by methods of manufacture

Method of manufacture	1942		1943	
	Short tons	Value	Short tons	Value
Evaporated:				
Bulk:				
Open pans or grainers	500,758	$4,607,104	532,747	$5,083,816
Vacuum pans	2,234,633	13,916,501	2,593,316	16,509,975
Solar	542,087	2,238,604	598,772	2,538,341
Pressed blocks	240,354	2,228,062	269,064	2,598,873
Rock:				
Bulk	2,734,797	9,054,447	3,181,226	10,512,857
Pressed blocks	67,490	569,014	77,912	668,027
Salt in brine (sold or used as such)	7,373,165	5,530,502	7,961,115	5,966,377
	13,693,284	38,144,234	15,214,152	43,878,266

Evaporated salt.—Sixty plants produced evaporated salt in 12 States and Puerto Rico, chiefly in Michigan, Texas, California, Ohio, New York, and Kansas.

Evaporated salt sold or used by producers in the United States, 1942–43, by States

State	1942		1943	
	Short tons	Value	Short tons	Value
California	463,357	$2,286,815	486,013	$2,579,509
Kansas	335,188	2,628,892	379,666	2,924,912
Louisiana	62,825	460,919	64,547	478,357
Michigan [1]	1,154,732	6,846,862	1,198,062	7,841,282
New York	425,216	4,355,825	447,749	4,909,059
Ohio	464,841	3,413,416	467,156	3,365,293
Oklahoma	8,305	35,132	7,716	30,496
Puerto Rico	18,198	103,071	17,505	109,337
Texas	304,403	1,584,008	(2)	(2)
Utah	103,334	256,124	161,967	526,999
West Virginia [1]	140,216	822,794	144,112	906,076
Other States [3]	37,217	196,413	619,406	3,059,685
	3,517,832	22,990,271	3,993,899	26,731,005

[1] Includes a quantity of salt contained in brine for chemical use reported as evaporated salt with value as evaporated salt.

[2] Included under "Other States."

[3] 1942: Colorado, Nevada, and New Mexico; 1943: Nevada, New Mexico, and Texas.

Rock salt.—Twenty plants produced rock salt in eight States. For many years four States produced more than 90 percent of the national total. Because of the small number of producers of rock salt and salt in brine in certain States, it is impossible to show either rock salt or salt in brine separately, by States, if State totals for all classes of salt are published. Therefore, only annual totals are shown in the following table.

Rock salt sold by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	2,035,157	$6,496,807	1942	2,802,287	$9,623,461
1940	2,265,548	7,384,839	1943	3,259,138	11,180,884
1941	2,619,087	8,761,827			

Pressed blocks.—Salt blocks sold in 1943 showed a gain of 13 percent in quantity and 17 percent in value compared with 1942. Twenty plants produced blocks from evaporated salt, and 8 produced blocks from rock salt. The output consisted of plain, iodized, and sulfurized salt blocks.

Pressed-salt blocks sold by original producers of the salt in the United States, 1939–43

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	152, 121	$1, 136, 527	39, 242	$263, 300	191, 363	$1, 399, 827
1940	152, 267	1, 193, 237	40, 171	282, 435	192, 438	1, 475, 672
1941	182, 331	1, 505, 040	56, 701	461, 265	239, 032	1, 966. 305
1942	240, 354	2, 228, 062	67, 490	569, 014	307, 844	2, 797, 076
1943	269, 064	2, 598, 873	77, 912	668, 027	346, 976	3, 266, 900

Salt content of brine.—Eleven plants in seven States produced 7,961,115 short tons of salt in brine in 1943, or 52 percent of the national total of all types of salt. The brine supplies salt needed for a substantial part of the chemical industry of the country, as salt tops the list of raw materials used in the chlorine and alkali industries and is utilized for many other chemicals. The increased use of salt in brine parallels the remarkable growth of the chemical industries. For quite a number of years the United States has led the world in these industries; and at the beginning of World War II, according to Falk,[1] it already supplied two-fifths of the world chemical production.

MODERN PRACTICES

Although many improvements in details have been evolved, no great basic changes have occurred recently in the United States in methods of producing salt from mines, wells, ponds, and playas.

Descriptions have been given recently of the Retsof (New York) and other mines of the International Salt Co.,[2] the Jefferson Island Salt Co. mine and works (Louisiana) rebuilt in 1941,[3] and the Kleer Salt mine (Kansas).[4] The Retsof mine operates in beds more than 1,000 feet below the surface, and the Detroit mine (Michigan) is more than 1,100 feet deep.

Of the three main mechanical methods of evaporating salt from brine—vacuum pan, open pans, and grainers (or by the Alberger modified open-pan method)—the vacuum-pan process requires the most costly equipment consisting of a complicated system of tubing, pans, and other equipment made of noncorrosive metals. As the metals and equipment required are the same as those used on battleships and other Navy craft, replacements and extensions of vacuum-process salt plants have been under strict priority control for the last few years. All three methods employed at the Diamond Crystal salt plant in Michigan were described in an article several years ago.[5]

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[1] Falk, Carl, Our Enemies, Chemically Speaking: Chem. and Met. Eng., January 1942, pp. 80–81.

[2] Looker, C. D., Salt as a Chemical Raw Material: Chem. Ind., November 1941, pp. 594–601; December 1941, pp. 790–799.

[3] Roll, W. H., Blasting Salt Below Sea Level: Explosives Eng., January-February 1943, pp. 7–14.

[4] Veitch, W. M., Mining Salt Beneath the Kansas Prairies: Explosives Eng., September-October 1943, pp. 180–182 and 198.

[5] Lee, James A., A Salt for Every Use: Chem. and Met. Eng., August 1940, pp. 530–534.

Evaporation by solar heat and the harvesting methods practiced on the Pacific coast and at Great Salt Lake have been described in previous Yearbook chapters, but a unique experiment in solar evaporation is being tested at an inland sea in Mexico.[6] Ponds constructed spirally are so arranged that it takes 1 year for the brine to reach the center of the spiral, from which it goes to the crystallizers where complete evaporation is attained. Other salts in addition to sodium chloride are obtained.

Since iodized salt first came on the market in Michigan in 1924, production has increased steadily, and markets have expanded to national proportions. At present about half of the table salt produced is iodized.

Although salt must be in solution for utilization in some processes—notably magnesium-metal manufacture—users have found it economical of time, labor, and equipment to purify the salt first by the vacuum-pan method and later to redissolve it because the impurities contained in the unrefined brine clog the process or otherwise are deleterious.

C. D. Looker's article (cited in footnote 2) contains a useful table for testing sodium chloride brines.

Some of the wells in the United States yielding brine for the production of chemicals and evaporated salt penetrate the salt beds several thousand feet below the surface. The deepest on record is the 6,000-foot well of the Defense Plant Corporation that began large-scale operation at Natrium, W. Va., in 1943, to supply salt brine from which liquid chlorine and caustic soda are produced. The West Virginia location was chosen as it is above an extensive salt deposit, and fuel (coal and gas) and electric power are available nearby. It is adjacent to large markets and has both water and rail transportation.

DISTRIBUTION

The accompanying table shows movement of original shipments of evaporated and rock salt into the various States but not reshipments. Although some of the large salt companies maintain transshipment warehouses, the following table gives a valid pattern of distribution, as salt is such a cheap commodity at its point of origin that it cannot be sent too far afield or heavy freight costs make its selling price too high to compete with products located more favorably.

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[6] Gerstel, Alice R., Developments in Lake Texcoco: Chem. and Eng. News, October 25, 1942, pp. 1300-1302.

Distribution (shipments) of evaporated and rock salt in the United States, 1942–43, by States of destination, in short tons

Destination	1942		1943	
	Evaporated	Rock	Evaporated	Rock
Alabama	8,432	58,835	9,745	73,376
Arizona	11,814	2,673	11,771	3,298
Arkansas	8,011	28,144	7,625	54,026
California	277,696	54,578	309,702	29,913
Colorado	39,535	28,349	41,880	38,506
Connecticut	16,020	7,239	16,335	11,246
Delaware	3,921	11,361	3,680	9,080
District of Columbia	5,361	2,060	5,206	1,954
Florida	7,618	25,601	8,987	26,599
Georgia	17,766	55,541	20,107	55,227
Idaho	13,949	1,653	21,198	1,148
Illinois	257,710	184,395	272,041	218,684
Indiana	90,534	61,002	94,637	67,238
Iowa	116,022	99,564	131,869	110,071
Kansas	51,543	175,486	61,604	174,363
Kentucky	38,036	29,673	35,298	73,473
Louisiana	5,670	76,972	6,664	118,776
Maine	11,484	40,123	12,053	38,781
Maryland	29,399	28,795	33,371	54,865
Massachusetts	58,101	52,712	53,645	62,250
Michigan	384,960	54,219	405,738	58,287
Minnesota	120,752	66,255	125,767	75,910
Mississippi	3,559	32,447	4,052	30,904
Missouri	79,429	65,553	88,600	74,827
Montana	20,608	6,692	22,404	2,858
Nebraska	45,832	51,129	60,296	60,567
Nevada	43,569	29,000	57,253	79,715
New Hampshire	9,260	41,273	5,268	48,989
New Jersey	84,366	153,887	92,242	177,793
New Mexico	9,746	14,146	12,956	12,335
New York	204,361	429,375	212,753	478,726
North Carolina	53,326	53,561	55,637	51,061
North Dakota	11,594	5,110	12,364	4,445
Ohio	216,898	95,172	215,467	109,245
Oklahoma	33,312	36,422	31,564	39,768
Oregon	29,684	120	36,582	456
Pennsylvania	150,806	101,980	159,040	115,126
Rhode Island	10,071	10,472	9,855	11,274
South Carolina	8,513	22,519	11,393	18,241
South Dakota	19,688	12,480	22,408	20,614
Tennessee	26,631	49,086	31,311	53,172
Texas	315,777	189,759	579,232	187,900
Utah	22,135	3,316	26,261	3,806
Vermont	4,982	8,675	5,433	9,854
Virginia	52,544	63,790	55,311	79,120
Washington	125,528	941	139,685	562
West Virginia	167,864	75,171	169,298	79,871
Wisconsin	129,307	26,553	128,591	27,784
Wyoming	7,755	2,073	9,026	3,956
Other [1]	56,353	81,355	50,694	119,098
	3,517,832	2,802,287	3,993,899	3,259,138

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[1] Includes salt used in Puerto Rico (evaporated salt); exports to Africa, Canada, Central America, Cuba, Mexico, Newfoundland, South America, West Indies, and other countries; shipments to Alaska, Hawaii, and Puerto Rico; and some shipments to unspecified destinations.

Salt shipped to noncontiguous Territories of the United States, 1942–43

Territory	1942		1943	
	Short tons	Value	Short tons	Value
Alaska	4,829	$94,646	3,168	$73,160
American Samoa	14	1,186	1	67
Hawaii	2,668	109,222	1,905	42,854
Puerto Rico	1,004	34,100	1,684	68,723
Virgin Islands	53	3,562	75	5,042

USES

Even before salt is divided into its chemical elements, sodium and chlorine, it has wide utility, and after separation each part has a long list of uses. The accompanying table gives only the broad fields of consumption.

In 1943 increases were noted in five of the seven large uses: Soda ash, chlorine, miscellaneous chemicals, meat packing, and livestock. The quantity used for water treatment was only slightly lower in 1943 than 1942. Table-salt output decreased in 1943. The quantity of table salt required is usually stable and follows the rise in population rather closely. However, in 1942 it increased 188,963 tons and in 1943 decreased 19,259 tons, although the output nevertheless was well above that in normal peacetime years. Part of the decline may be attributed to the fact that large quantities were sold the latter part of 1942, but transportation facilities for moving it to the consumers were not obtained until well into 1943. Requirements of the foregoing seven primary uses absorbed 13 million of the 15 million tons of salt sold or used for all purposes in 1943. However, although many of the other uses require only relatively small quantities, these amounts are important, as no substitute can be used so readily or cheaply as salt.

Salt sold or used by producers in the United States, 1942–43, by classes and uses, in short tons

Use	1942			1943		
	Evaporated	Rock	Brine	Evaporated	Rock	Brine
Chlorine, bleaches, chlorates, etc.	843,970	704,227	654,686	1,138,691	770,620	746,982
Soda ash	218	20	6,670,621	2	110	7,157,534
Dyes and organic chemicals	78,752	44,485		54,772	78,529	
Soap (precipitant)	28,118	13,360		37,717	15,974	
Other chemicals	60,849	254,198	(1)	131,674	376,376	(1)
Textile processing	41,535	77,189		39,705	81,954	
Hides and leather	118,976	182,650		103,728	191,014	
Meat packing	426,976	322,938		459,593	375,815	
Fish curing	28,908	32,007		32,724	53,463	
Butter, cheese, and other dairy products	94,050	6,642		108,740	9,920	
Canning and preserving	135,358	19,223		137,532	13,149	
Other food processing	194,714	17,857		205,548	16,841	
Refrigeration	32,536	153,010		31,841	179,152	
Livestock	556,885	246,340		625,675	232,730	
Highways, railroads, dust and ice control	13,414	197,751	(1)	12,912	283,131	
Table and other household	460,020	224,764		480,682	184,843	
Water treatment	171,433	203,757	(1)	174,460	200,018	(1)
Agriculture	81,700	16,968		46,127	16,455	
Metallurgy	31,990	33,347		43,794	31,099	
Other uses [2]	117,430	51,554	47,858	127,982	147,945	56,599
	3,517,832	2,802,287	7,373,165	3,993,899	3,259,138	7,961,115

[1] Included under "Other uses."

[2] Includes also exports where use is not specified.

"Other uses" in the table includes several applications that are expanding. More than 66,000 short tons of salt (about 7,000 tons of evaporated and 59,000 tons of rock salt) were reported consumed in the manufacture of synthetic rubber and rubberlike materials. This quantity was exclusive of chlorine and other salt derivatives reported in the table, that were also used therein. A new many-purpose rubberlike plastic called Marvinol, a basic ingredient of which is salt, developed by the Glenn L. Martin Co., Baltimore, Md., was announced in the fall of 1943.

Other miscellaneous uses not given in detail include glass, pulp and paper, fertilizer, tobacco, refractories, clay, brick, tile and sewer pipe, pottery and ceramics, weed killers, and candles.

The war uses of salt, discussed in two previous chapters, were enlarged in 1943. Magnesium-metal manufacture consumed many thousands of tons. The world's largest magnesium plant completed its first full year of operation; the final unit was completed in midsummer of 1943. Other new magnesium-metal making units requiring salt also began operation in 1943. The magnesium plants that dropped out of production in 1943 did not require salt as a basic material.

Common salt is the only raw material from which chlorine is produced. Wartime demand for it increased, and, in 1943, 2,656,293 tons of all classes of salt were consumed in its manufacture. To make 1 short ton of chlorine requires more than 3,000 pounds of salt. As war demands increased, more drastic control of civilian supplies was exerted. Pulp and paper manufacture and rayon and other fabrics suffered further curtailment. Moreover, the War Production Board recommended that ways be developed to utilize waste chlorine gas from magnesium operations and suggested other conservation means.

Within the past year or two a new insecticide, known as D. D. T. (dichloro-diphenyl-trichloroethane) has been developed, in which chlorine is a basic ingredient. This chemical has proved so efficacious in destroying and repelling vermin and other insects that it has been extremely useful to the military forces. There is not enough for civilian use at present.

Salt, when processed with limestone and ammonia, yields soda ash, from which caustic soda and other alkalies are derived. When salt in solution is subjected to the electrolytic method it is broken down into chlorine and caustic soda. The market for these products was large in 1943, augmented by heavy export demand of the sodium compounds, especially by Mexico and South America. Large shipments were made for war requirements and lend-lease.

POST-WAR PROSPECTS

Requirements of some of the present large uses of salt undoubtedly will shrink after the war, but when restrictions on civilian consumer goods are relaxed some compensating gains will materialize. In addition, many of the war-fostered products will shift to other markets, where new adaptations are already indicated.

Salt has attained great importance in magnesium-metal manufacture, and magnesium may find extensive uses in peacetime industry. However, this use of salt may be limited by chlorine-recycling methods now being developed.

Synthetic rubber manufacture, now an established and growing industry which is expected to continue on a substantial basis, promises a large peacetime market for salt. Moreover, new rubberlike materials involving the use of salt derivatives have been invented. Marvinol, now limited to military use in airplane parts, inner tubes for tires, gloves, and similar articles, can be employed for many comparable civilian purposes after the war.

A temporary increase in salt requirements for textile processing and for dyes may be expected when men discard uniforms for civilian clothes and foreign rehabilitation programs reach their peaks. It is also expected that more textiles will be exported, especially cotton.

War demands for chlorine have been so great that civilian supplies have been cut. The dry-cleaning and paper-bleaching industries have been handicapped particularly, and when supplies of chlorine are again available these large uses will be reestablished. The normal needs of the paper industry that are now inadequately supplied are very great. To bleach each ton of dry sulfate pulp to what is known as 80–85 G. E. brightness requires 40 pounds of caustic soda and 140 to 200 pounds of chlorine.

D. D. T. insecticide, mentioned in the discussion of uses, has proved so beneficial in protecting military services against different types of vermin that when it is possible to release it for civilian use it will be much in demand.

Plastics are forging ahead; many of them require salt derivatives. War uses have been found for them that may be adapted to peacetime use. New combinations and uses of rayons have been discovered, adaptable for peacetime applications.

According to the Heyden Chemical Corporation, New York,[7] Latin American drug houses, pharmacies, and laboratories are eagerly awaiting post-war imports of salt derivatives from the United States. However, it should not be overlooked that some of the Latin American countries, notably Brazil and Mexico, are trying to develop their own chemical industries. Mexico is endeavoring to develop its brine wells for chemical manufacture, but the main obstacle has been inability to obtain necessary metals and equipment.

Production of salt for food uses increases steadily with the rise in population. Moreover, whatever part the United States takes in supplying foreign countries with prepared, canned, or processed foods and livestock feed will require its proportionate share of salt. Food specialists have estimated that 40 million tons of food and feed will be necessary for the people and livestock of 20 nations to maintain them until domestic crops are available. Most of the food must come from the Americas—a large part of it from the United States. Studies of post-war food problems now being made by Government agencies include estimates of salt, both for direct consumption and as a constituent or preservative of various food products for both domestic and foreign use. Salt may also be exported in considerable quantities to aid in the rehabilitation of foreign chemical and metallurgical industries.

CHANGES IN THE INDUSTRY

California.—The Defense Plant Corporation unit of the California Rock Salt Co. began operation in 1943 to supply salt for the manufacture of magnesium metal. Mullet Island Salt Co. was not producing in 1943, but resumption of activity is anticipated. Surprise Valley Salt Works was idle in 1943 and has been closed permanently. The Reeder Salt Co. did not produce in 1943 but will resume operation.

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[7] Oil, Paint and Drug Reporter, November 29, 1943, p. 66.

Colorado.—Although a user of salt, the United States Vanadium Corporation at Uravan (holder of a Government salt lease) did not produce in 1942 or 1943.

Michigan.—Saginaw Salt Products Co. closed its works on June 20, 1943, for the duration of the war. Wyandotte Chemicals Corporation (formerly Michigan Alkali Co.) is a consolidation of the Michigan Alkali Corporation and the J. B. Ford Co., which became effective January 1, 1943.

New Mexico.—International Minerals & Chemical Corporation, formerly Union Potash & Chemical Co., produced common salt as a byproduct. Of the several hundred thousand tons produced annually, only a small quantity is sold to a dealer for livestock use. The salt works at Artesia, formerly operated by Atanacio Pelaez but operated by his son Paz Pelaez in 1943, are now known as Paz Pelaez Salt Lakes. On August 1, 1943, Frank Aubrey acquired the works of the Salt Supply Co. at Carlsbad. Salt is recovered from the dump of the Potash Company of America and is used locally for livestock.

New York.—The Worcester Salt Co., whose evaporated-salt plant at Silver Springs was purchased by the Morton Salt Co. in March 1943, continued to operate as a unit.

Oklahoma.—The plant of the Oklahoma Salt Industries, Inc., reopened late in February 1943 after damage by fire had incapacitated it for output in January and most of February.

Utah.—Jesse Coulson (lake at Nephi) produced no salt in 1943, and the works are closed temporarily. Although Bonneville, Ltd., at Wendover claims that it has unlimited supplies of raw salt it produced none in 1943. The Crystal White Salt Co., which has not produced for the past 3 years, has been reorganized and expects to produce in 1944.

West Virginia.—Pittsburgh Plate Glass Co. began operating the Defense Plant Corporation Natrium plant in July and attained full operation in October 1943.

IMPORTS AND EXPORTS[8]

Salt imported for consumption in the United States, 1942–43, by countries

Country	1942		1943	
	Short tons	Value	Short tons	Value
North America:				
Canada	1,358	$12,430	1,256	$12,621
Dominican Republic	------	------	2	129
Mexico	28	144	------	------
West Indies:				
British: Jamaica	4,142	14,767	------	------
Curaçao (N. W. I.)	56	260	------	------
Africa: Egypt	2,170	1,700	------	------
	7,754	29,301	1,258	12,750

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[8] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Salt imported for consumption in the United States, 1939–43, by classes

Year	In bags, sacks, barrels, or other packages (dutiable) [1]		Bulk			
			Dutiable		Free (used in curing fish)	
	Short tons	Value	Short tons	Value	Short tons	Value
1939	2,121	$14,977	28,451	$58,540	15,461	$27,700
1940	1,024	6,601	16,413	59,029	[2] 12,965	[2] 25,174
1941	1,110	12,156	6,896	17,021	7,426	30,058
1942	367	4,138	953	7,496	[2] 6,434	[2] 17,667
1943	129	2,425	1,129	10,325	-------	-------

[1] Includes 98 pounds valued at $3 imported free in 1942 and 12,939 pounds valued at $493 in 1943.

[2] Includes salt in bags, barrels, or other packages as follows: 1940: 6 tons, $12; 1942: 122 tons, $1,200; 1939, 1941, and 1943: None reported.

Exports shown include salt shipped through lend-lease and supplies for food committees. Most of the exports were rock salt, but enough high-quality table salt and special salt were shipped to raise the value of total shipments.

Salt exported from the United States, 1942–43, by countries

Country	1942		1943	
	Short tons	Value	Short tons	Value
North America:				
Bermuda	141	$6,296	21	$1,457
Canada	72,617	321,907	79,374	458,430
Central America:				
British Honduras	673	7,715	484	6,128
Guatemala	25	629	17	521
Honduras	119	2,393	104	2,663
Nicaragua	190	3,617	445	10,713
Panama:				
Canal Zone	933	23,794	-------	-------
Republic of	27	1,917	12	775
Greenland	2,513	35,835	3,509	38,175
Iceland	34	2,008	9	562
Mexico	5,686	88,154	8,235	147,047
Newfoundland and Labrador	21,899	106,216	40,509	253,023
West Indies:				
British:				
Barbados	-------	-------	325	5,529
Other British	168	3,302	86	2,496
Cuba	9,437	121,725	9,166	128,901
Curaçao (N. W. I.)	132	7,092	160	3,038
Dominican Republic	111	2,229	75	3,529
Haiti	15	945	34	2,187
Other North America	174	2,820	8	366
South America:				
Argentina	332	3,409	215	2,115
Brazil	26	668	182	10,852
British Guiana	509	21,060	348	7,317
Colombia	(1)	118	2	469
Surinam	102	1,397	202	4,233
Other South America	298	5,090	12	1,717
Europe:				
Gibraltar	-------	-------	26	4,093
U. S. S. R	1,402	95,951	480	28,342
Other Europe	-------	-------	1	211
Asia	7	736	1	141
Africa:				
Algeria	-------	-------	126	9,075
Liberia	548	12,790	1,233	33,688
Other Africa	92	3,701	50	4,098
Oceania:				
British:				
Australia	-------	-------	3	243
New Zealand	42	3,182	8	403
Other British	4	425	-------	-------
French	258	5,040	251	5,603
	118,424	892,160	145,803	1,173,139

[1] Less than 1 ton.

WORLD PRODUCTION

In 1943 the Canadian Government began construction of a pilot plant at Malagash, Nova Scotia, to produce from impure salt a product of the required purity and texture for fishery purposes. Since August 1, 1943, all salt associations in Germany have been dissolved except the German Salt Federation. Salt mines in Poland are being utilized by the Germans. Union of South Africa has been forced to depend upon domestic salt sources since the war cut off imports. All orders for salt requirements in New Zealand for the duration of the war will be handled by the Salt Association, composed of importing agents, formed in that country in 1943. Operations to obtain solar salt from sea water in the Lake Grassmere area of New Zealand began in 1943. Free China expected to produce well over a million tons of salt in seven districts in 1943. Occupied China's Changlu fields, Japan claimed, had already exceeded 1942 output by 50 percent by the fall of 1943, chiefly because of opening new fields. Salt output in North China was expected to reach a record.

World production of salt, 1938–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943
North America:						
Canada	398, 013	385, 550	420, 974	510, 930	591, 343	634, 897
Costa Rica	4, 740	6, 822	(2)	6, 000	7, 727	3, 414
Dominican Republic	9, 286	9, 536	7, 500	14, 700	5, 590	12, 620
Guatemala	10, 465	(2)	(2)	(2)	11, 600	12, 440
Mexico	107, 701	(2)	(2)	(2)	584, 000	744, 000
Panama	3, 332	4, 536	5, 199	(2)	9, 526	(2)
United States:						
Rock salt	1, 725, 330	1, 846, 254	2, 055, 260	2, 375, 983	2, 542, 179	2, 956, 625
Other salt	5, 555, 486	6, 570, 481	7, 343, 089	9, 163, 917	9, 880, 094	10, 845, 349
West Indies:						
British:						
Bahamas	17, 900	11, 600	27, 000	25, 400	(2)	(2)
Turks and Caicos Islands (exports)	35, 578	47, 389	67, 028	48, 179	(2)	(2)
Cuba	57, 970	113, 398	113, 398	41, 909	43, 545	(2)
Netherlands (exports)	2, 013	247	37	3, 226	(2)	(2)
South America:						
Argentina:						
Rock salt	----------	700	350	860	355	(2)
Other salt	264, 150	303, 321	292, 307	372, 689	364, 279	(2)
Brazil	788, 218	502, 203	(2)	550, 000	(2)	(2)
Chile	27, 772	39, 593	44, 317	57, 185	55, 578	(2)
Colombia:						
Rock salt	4, 010	3, 950	4, 703	4, 530	4, 816	(2)
Other salt	199, 022	218, 134	228, 750	192, 249	103, 926	(2)
Ecuador:						
Rock salt	----------	----------	(2)	----------	(2)	(2)
Other salt	13, 800	16, 145	29, 900	20, 207	(2)	(2)
Peru	38, 451	39, 669	41, 326	46, 855	37, 079	(2)
Venezuela	22, 658	20, 473	52, 540	40, 123	17, 837	33, 838
Europe:						
Bulgaria:						
Rock salt	10, 242	13, 168	15, 000	(2)	(2)	(2)
Other salt	66, 258	(2)	65, 000	(2)	(2)	(2)
Czechoslovakia	174, 000	(2)	(2)	(2)	(2)	(2)
France:						
Rock salt and salt from springs	1, 264, 230	(2)	(2)	(2)	(2)	(2)
Other salt	346, 046	(2)	(2)	(2)	(2)	(2)
Germany:						
Rock salt	2, 694, 984	(2)	(2)	(2)	(2)	(2)
Other salt	585, 326	(2)	(2)	(2)	(2)	(2)
Austria:						
Rock salt	786	(2)	(2)	(2)	(2)	(2)
Other salt	93, 576	(2)	(2)	(2)	(2)	(2)
Greece	102, 057	(2)	(2)	(2)	(2)	(2)
Italy:						
Rock salt	613, 870	(2)	(2)	(2)	(2)	(2)
Other salt	885, 205	(2)	(2)	(2)	(2)	(2)

See footnotes at end of table.

World production of salt, 1938–43, by countries, in metric tons—Continued

Country [1]	1938	1939	1940	1941	1942	1943
Europe—Continued.						
Malta	1,523	1,753	(2)	(2)	(2)	(2)
Netherlands: Rock salt	164,266	(2)	(2)	(2)	(2)	(2)
Poland	642,875	(2)	(2)	(2)	(2)	(2)
Portugal (exports)	6,096	9,289	11,955	6,981	747	50
Rumania:						
Rock salt	350,618	(2)	(2)	(2)	280,038	363,151
Other salt	1,140	(2)	(2)	(2)		
Spain:						
Rock salt	150,878	157,784	206,650	195,686	(2)	(2)
Other salt	102,671	661,269	463,795	358,217	(2)	(2)
Switzerland	84,049	90,000	77,000	(2)	(2)	(2)
United Kingdom:						
Great Britain:						
Rock salt	19,974	(2)	(2)	(2)	(2)	(2)
Other salt	2,651,939	(2)	(2)	(2)	(2)	(2)
Ireland, Northern:						
Rock salt	2,362	(2)	(2)	(2)	(2)	(2)
Other salt	5,757	(2)	(2)	(2)	(2)	(2)
Yugoslavia	52,634	54,213	(2)	(2)	[3] 28,000	(2)
Asia:						
Aden	282,510	294,077	258,714	(2)	(2)	(2)
Burma	39,319	(2)	(2)	(2)	(2)	(2)
Ceylon	36,490	37,556	29,973	(2)	(2)	(2)
China (including Manchuria)	[4] 3,000,000	[4] 3,000,000	[4] 3,000,000	[5] 1,152,000	[5] [6] 800,000	(2)
Chosen [4]	138,000	138,000	138,000	(2)	(2)	(2)
Cyprus [4]	3,000	3,000	3,000	(2)	(2)	(2)
India:						
British:						
Rock salt	191,395	196,503	(2)	(2)	(2)	(2)
Other salt	1,372,979	1,326,544	(2)	(2)	(2)	(2)
Portuguese	29,527	27,979	38,564	(2)	(2)	(2)
Indochina	193,050	213,526	166,000	(2)	(2)	(2)
Iraq	7,907	9,107	8,779	(2)	(2)	(2)
Netherlands Indies	90,909	[7] 141,208	[7] 388,837	(2)	(2)	(2)
Palestine:						
Rock salt	444	645	599	(2)	(2)	(2)
Other salt	8,065	8,736	9,944	(2)	(2)	(2)
Syria [4]	10,000	10,000	10,000	(2)	(2)	(2)
Thailand (exports)	156,268	95,170	112,197	(2)	(2)	(2)
Turkey	247,293	(2)	(2)	(2)	(2)	(2)
Africa:						
Algeria	74,630	(2)	(2)	(2)	(2)	(2)
Belgian Congo	1,013	(2)	1,038	(2)	(2)	(2)
British Somaliland	353	(2)	(2)	(2)	(2)	(2)
Canary Islands [4]	2,000	2,000	2,000	(2)	(2)	(2)
Egypt (exports)	284,949	442,532	[8] 168,591	(2)	(2)	(2)
Ethiopia: Rock salt [4]	10,000	10,000	10,000	(2)	(2)	(2)
French West Africa (exports)	51	(2)	(2)	(2)	(2)	(2)
Kenya Colony	3,250	(2)	9,425	(2)	(2)	(2)
Libya (Italian Africa):						
Cyrenaica [4]	10,000	10,000	10,000	(2)	(2)	(2)
Tripolitania [4]	20,000	20,000	20,000	(2)	(2)	(2)
Mauritius [4]	1,500	1,500	1,500	(2)	(2)	(2)
Morocco, French	909	(2)	(2)	(2)	[4] 55,000	(2)
Nigeria [4]	400	400	400	(2)	(2)	(2)
Portuguese East Africa	6,448	6,628	251	(2)	(2)	(2)
Portuguese West Africa (Angola) [4]	25,000	25,000	25,000	(2)	(2)	(2)
South-West Africa:						
Rock salt	641	751	1,125	[9] 671	[6] 1,655	[6] 1,409
Other salt	4,431	4,704	5,364	[9] 3,445	[6] 5,909	[6] 5,774
Sudan, Anglo-Egyptian	37,532	40,633	40,471	(2)	(2)	(2)
Tanganyika Territory	9,678	9,472	9,505	(2)	(2)	(2)
Tunisia	129,287	(2)	(2)	(2)	(2)	(2)
Uganda	3,169	2,626	3,374	(2)	(2)	(2)
Union of South Africa	117,717	(2)	(2)	(2)	(2)	(2)
Oceania:						
Australia:						
South Australia	76,013	80,759	146,991	173,431	(2)	(2)
Western Australia	3,850	(2)	(2)	(2)	(2)	(2)

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[1] In addition to the countries listed salt is produced in Albania, Bolivia, Eritrea, French Somaliland, Gold Coast, Japan, Leeward Islands, Madagascar, Philippine Islands, Southern Rhodesia, Taiwan, U. S. S. R., and Victoria (Australia), but figures of production are not available.

[2] Data not available.

[3] January to June, inclusive (Croatia only).

[4] Estimated annual production.

[5] Unoccupied China.

[6] January to September, inclusive.

[7] Incomplete data.

[8] January to July, inclusive.

[9] January to June, inclusive.

MAGNESIUM COMPOUNDS AND MISCELLANEOUS SALINES

BY CHARLES L. HARNESS AND NAN C. JENSEN [1]

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SUMMARY

Greatly expanded production of raw materials for the manufacture of magnesium metal and other war uses characterized the magnesite and natural salines industries in 1943. Increased demands for refractory magnesia drew on a variety of raw materials, including magnesite, brucite, dolomite, raw sea water, sea-water bitterns, and well brines. Calcium chloride was used increasingly in road and airfield stabilization. Demand for bromine in antiknock fluids increased, resulting in a record output of ethylene dibromide. Domestic production and imports of Chilean iodine mounted in 1943 in anticipation of a heavy war demand for antiseptics. Labor shortages reduced the production of natural sodium sulfate, but the output of natural sodium carbonates and borates rose. The three salts are used extensively in glassmaking.

Part I.—MAGNESIUM COMPOUNDS

MAGNESITE

Production of magnesium metal in excess of rated capacity of the plant of Basic Magnesium, Inc., Las Vegas, Nev., accounted largely for the tremendous increase in production of magnesite in 1943 over 1942. Refractory demands also were heavy. The American Iron and Steel Institute reported basic open-hearth steel-furnace annual capacity as 83.3 million short tons as of January 1, 1944, compared with 77.6 at the beginning of 1943 and 76.5 on January 1, 1942. The new construction involved during 1943 created such heavy demands for refractory brick that magnesite and sea-water sources combined were inadequate to satisfy the periclase requirements, and much refractory brick was made with a lower periclase content than usual. The program of new construction was so nearly completed by the end of the year that a shift in demand from brickmaking to maintenance grades of magnesite was indicated, and refractory producers were planning their production schedules accordingly.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

The authors of this chapter prepared a circular during 1943 dealing with general aspects of the magnesite industry.[2]

Commercial caustic-calcined magnesium oxide is obtained by calcining magnesite or by extracting it from magnesium-bearing liquors or dolomite. Caustic-calcined magnesium oxide is available in many purities and at widely varying prices. That obtained by calcining magnesite is the least pure, a characteristic analysis (calcined basis) being MgO 82.5, SiO_2 11.0, Fe_2O_3 2.0, Al_2O_3 0.5, and CaO 1.8 percent. Such material, however, is quite suitable for oxychloride cements and fertilizers. Somewhat higher grades (83 to 95 percent MgO) are generally used in making magnesium chemicals, including Epsom salts.

Salient statistics of the magnesite industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Crude:					
Mined:[1]					
Short tons	198, 980	333, 166	374, 799	497, 368	754, 832
Value	$1, 465, 190	$2, 487, 969	$2, 655, 547	$3, 874, 334	$6, 071, 596
Sold by producers:					
Short tons	1, 123	2, 133	4, 536	6, 835	4, 090
Value	$15, 752	$32, 810	$54, 045	$57, 350	$47, 788
Average per ton[2]	$14. 03	$15. 38	$11. 91	$8. 39	$11. 68
Imports for consumption:					
Short tons	569	22			
Value	$5, 456	$761			
Caustic-calcined magnesia:					
Sold or used by producers:[3]					
Short tons	10, 157	16, 261	30, 225	[4] 41, 889	191, 792
Value	$310, 102	$512, 607	$1, 052, 077	[4] $2, 028, 126	$11, 497, 505
Average per ton[2]	$30. 53	$31. 52	$34. 81	[4] $48. 42	$59. 95
Imports for consumption:					
Short tons	2, 218	928	864	578	290
Value	$51, 884	$21, 301	$23, 972	$19, 105	$13, 122
Refractory magnesia:					
Sold or used by producers:[5]					
Short tons	86, 077	140, 668	201, 481	273, 661	301, 382
Value	$1, 699, 723	$2, 802, 537	$5, 052, 879	$7, 823, 963	$9, 341, 183
Average per ton[2]	$19. 75	$19. 92	$25. 08	$28. 59	$30. 99
Imports for consumption:					
Short tons	44, 420	30, 951	36, 791	7, 728	9, 233
Value	$800, 664	$551, 536	$824, 068	$280, 342	$310, 407

[1] Partly estimated; most of the crude is processed by the mining companies, and very little enters open market.

[2] Average receipts f. o. b. mine shipping point.

[3] 1939–41: Includes caustic-calcined magnesite and caustic-calcined magnesia from sea-water bitterns; 1942–43: Includes caustic-calcined magnesite and caustic-calcined magnesia from sea-water bitterns, well brines, and raw sea water and from precipitated magnesium carbonate obtained from dolomite.

[4] Revised figures.

[5] 1939–40: Includes dead-burned magnesite and refractory magnesia from sea-water bitterns; 1941: Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, and sea-water bitterns; 1942–43: Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, sea-water bitterns, well brines, and raw sea water.

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[2] Harness, Charles L., and Jensen, Nan C., **Marketing Magnesite and Allied Products**: Bureau of Mines Inf. Circ. 7269, 1943, 52 pp.

Magnesia sold or used by producers in the United States, 1942–43, by kinds and sources

[Quantities and values reported apply to finished products, not raw materials]

Finished products	From magnesite		From brucite, dolomite, and sea-water bitterns		From well brines, dry-lake brines, and raw sea water	
	Short tons	Value	Short tons	Value	Short tons	Value
1942						
Caustic-calcined	[1] 25, 344	[1] $1,049,493	93, 521	$3, 907, 396	7, 467	$497, 434
Refractory	189, 218	4, 397, 766				
	[1] 214, 562	[1] 5, 447, 259	93, 521	3, 907, 396	7, 467	497, 484
1943						
Caustic-calcined	137, 300	7, 941, 587	8, 649	547, 888	45, 843	3, 008, 030
Refractory	185, 992	4, 426, 152	89, 283	3, 664, 258	26, 107	1, 250, 773
	323, 292	12, 367, 739	97, 932	4, 212, 146	71, 960	4, 258, 803

[1] Revised figures.

Magnesite imported for consumption in the United States, 1941–43, by countries

Country	1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value
LUMP CAUSTIC-CALCINED MAGNESITE						
Cuba	274	$8, 269	412	$12, 829	174	$7, 497
India and Dependencies	439	6, 982				
	713	15, 251	412	12, 829	174	7, 497
GROUND CAUSTIC-CALCINED MAGNESITE						
Canada	61	$2, 247	100	$3, 454		
Cuba			59	2, 126	106	$4, 750
Kwantung	13	285				
United Kingdom [1]	77	6, 189	7	696	10	875
	151	8, 721	166	6, 276	116	5, 625
DEAD-BURNED AND GRAIN MAGNESITE AND PERICLASE						
Canada	771	$75, 194	425	$41, 491	147	$14, 319
Germany	2, 102	37, 914				
Hungary	325	4, 763				
India and Dependencies	168	2, 300				
Kwantung	33, 425	703, 897				
U. S. S. R.			6, 723	219, 137	9, 086	296, 178
United Kingdom [1]			580	19, 714		
	36, 791	824, 068	7, 728	280, 342	9, 233	310, 497

[1] United Kingdom of Great Britain and Northern Ireland.

PRICES

Dead-burned grain magnesite as sold by Northwest Magnesite Co. remained at $22 a short ton f. o. b. Chewelah, Wash., during 1943. This price has been virtually static since 1928. Prices for the mined and synthetic magnesias of the Westvaco Chlorine Products Corporation were unchanged in 1943, except that bulk-mined periclase, 90 percent MgO, was raised from $38.74 a short ton in 1942 to $40.50 in

1943. Following is a price schedule of representative magnesias sold by this firm in 1943 (carlots, f. o. b. California): Caustic-calcined magnesite, bulk—$52.75, powdered—$58.75; calcined (sea-water) magnesia, bulk—$54, powdered—$60; mined periclase, bulk—85 percent, $38.24, 90 percent—$40.50; sea-water periclase, bulk—85 percent, $36.00, 90 percent—$36.50.

The Office of Price Administration published specific dollars-and-cents ceiling prices of basic refractories in M. P. R. 416 of June 28, 1943.

REVIEW BY STATES

California.—Johns-Manville Products Corporation, Redwood City, prepared 85-percent magnesia insulation for steam pipes and boilers, using crude magnesite as raw material. The Marine Magnesium Products Corporation continued to extract high-quality magnesia for medicinal and other purposes from raw sea water at South San Francisco, using the Chesny process.[3] The Permanente Metals Corporation produced magnesia from raw sea water at its Moss Landing plant (built in 1942) for use in its carbothermic magnesium retorts. The Permanente Cement Co., an affiliate of Permanente Metals Corporation, shipped magnesite from Gabbs, Nev., for dead-burning at San Jose, Calif., largely for export to Great Britain. Plant Rubber & Asbestos Works, San Francisco, produced 85-percent margnesia insulation at Emeryville and Redwood City, using sea-water bitterns as the raw material.

Westvaco Chlorine Products Corporation added a fifth kiln at Newark in the spring of 1943 to caustic-calcine crude magnesite. Both calcined dolomite and calcined oyster shells are now used to precipitate magnesia from sea-water bitterns. The magnesia content of the dolomite is precipitated with that of the bitterns. The Westvaco Chlorine Products Corporation mined magnesite at its Western mine at Livermore and its Bald Eagle mine at Gustine, both in California. The ore reserves of the Bald Eagle mine were virtually depleted in 1942, but some high-quality material was produced for blending with Luning (Nev.) magnesite, considerable quantities of which were calcined at the Bald Eagle kiln. Howat reviewed Westvaco's sea-water magnesia process.[4]

Bureau of Mines engineers who examined the Red Mountain magnesite mine in Stanislaus County, which has yielded 140,000 tons of magnesite in the past but is now shut down, estimate indicated reserves at 27,500 to 44,500 tons.[5]

Michigan.—Michigan Chemical Corporation, St. Louis, Mich., completed two new brine wells, one in the Dundee formation, the other in the Sylvania, to provide adequate additional raw material for its second magnesia unit, also completed in 1943. The magnesia is a special caustic-calcined oxide for use in compounding neoprene and other synthetic rubber. The first magnesia unit, completed in 1942, is also producing caustic-calcined magnesia, but partial conversion to periclase is planned for 1944. The magnesias are characterized by very low content of boron, manganese, and phosphorus.

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[3] Howat, D. D., Recent Developments in the Production of Magnesium: Mine and Quarry Eng., vol. 8, No. 12, December 1943, p. 269.

[4] Howat, D. D., Work cited in footnote 3.

[5] Bureau of Mines, Red Mountain Magnesite Mine, Stanislaus County, Calif.: Bureau of Mines War Minerals Rept. 105, 1943, 13 pp.

Nevada.—The huge magnesium-metal project of Basic Magnesium, Inc., at Las Vegas, which exceeded its rated capacity of 9⅓ million pounds of magnesium a month in the latter part of 1943, required large quantities of magnesite. The mineral was mined, ground, purified by froth flotation, and calcined at Toiyabe, Nev. The calcined product was shipped to Las Vegas for reduction. Operations of this firm have been reviewed by various authors.[6]

The Sierra Magnesite Co., owned jointly by Westvaco Chlorine Products Corporation (Newark, Calif.) and Henry J. Kaiser and his associates (Oakland, Calif.), mined magnesite from the Segerstrom property and other claims near Luning, and the crude mineral was shipped to Newark and San Jose, Calif., for calcining. At Newark the material is caustic-calcined for oxychloride cement and chemical use, whereas at San Jose it is dead-burned for refractory use and caustic-calcined for chemical use.

Texas.—C. E. Heinz continued production of magnesite at Llano, shipping it crude to a firm in Joplin, Mo., for grinding, and to Gardner and Cates, new magnesite producers at Llano, for calcining for fertilizer use. Meramec Minerals, Inc., shut down its Llano mine temporarily and had no output in 1943.

Washington.—The Northwest Magnesite Co., chief producer of refractory magnesite in the United States, mined its Finch and Allen-Moss deposits and operated its seven kilns at Chewelah at near capacity in 1943. Part of the magnesite mined was purified by froth flotation. The unfloated product was used chiefly for maintenance-grade refractories, but the flotation concentrates and some of the regular output went into refractory brick production.

It was reported that the Double Eagle mine 15 miles southwest of Chewelah was being diamond-drilled to determine the extent of its magnesite reserves. This mine produced considerable magnesite during World War I but has been inactive in recent years.[7]

FOREIGN COUNTRIES

Information on foreign developments in magnesite has been meager since the outbreak of the war. The latest Minerals Yearbook table showing world production by countries appeared in the volume reviewing 1939. During the 5-year period 1934–38 U. S. S. R. produced about 534,000 short tons of crude magnesite annually, followed by Austria with 403,000 tons, Manchuria 233,000 tons, United States 157,000 tons, Greece 134,000 tons, and Czechoslovakia 83,000 tons.

Australia.—An excellent review of the Australian magnesite industry appeared in Mineral Trade Notes.[8]

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[6] McCann, F. A., Refractories Used in Big Installation at Basic Magnesium, Inc., (U. S. A.): Refract. Jour., vol. 19, No. 11, November 1943, pp. 399–408.

Ramsey, R. H., The Why and How of Basic Magnesium: Eng. and Min. Jour., vol. 144, No. 10, October 1943, pp. 61–67. Magnesium—Production at the World's Largest Plant: Chem. and Met. Eng., vol. 50, No. 10, October 1943, pp. 98–101, 115.

Stelley, H. A., Magnesium: Pit and Quarry, vol. 36, No. 2, August 1943, pp. 49–54.

Trauffer, W. E., The Nonmetallic Phases of Magnesium Manufacture: Pit and Quarry, vol. 36, No. 9, March 1944, p. 88.

Special [Truman] Committee Investigating the National Defense Program, Rept. 10, part 17, Magnesium: U. S. Government Printing Office, Washington, D. C., 1944, 56 pp.

[7] Light Metal Age, vol. 1, No. 2, July 1943, p. 16.

[8] Bureau of Mines, Mineral Trade Notes, Confidential Ser. 13, July 1943, pp. 31–36.

Although magnesite has been produced in Queensland, New South Wales, Victoria, South Australia, and Western Australia, more than 90 percent of the output has come from two deposits at Fifield and Thuddungra in New South Wales. Total production for 1939, 1940, 1941, and 1942 was given as 25,302, 24,877, 27,698, and 34,952 long tons, respectively. During this period about 85 percent was used for domestic refractory purposes, 4 percent was used in magnesium metal, 1 percent was employed for miscellaneous purposes, and 10 percent was exported as calcined material.

Bahamas.—The plant of West India Chemicals, Ltd., to extract magnesia from sea water was not completed in 1943, but officials of the company indicated that construction would be completed in 1944.

Canada.—According to figures released by the Dominion Bureau of Statistics, the value of magnesitic dolomite produced in Canada in 1940 was $897,016 and in 1941, $831,041. In 1942 and 1943 both magnesitic dolomite and brucite were produced. The combined values were $1,059,374 in 1942 and $1,298,775 in 1943. No information on tonnages was published.

Goudge[9] reported expanding uses for the brucite being produced from deposits of brucitic limestone near Wakefield, Quebec:

> The greater part of the brucite magnesia produced at the present time is sold to Canadian Refractories, Ltd., where, after being dead-burned, the granules are used for the manufacture of basic refractories of special grade. The dead-burned granules possess certain physical properties that make them highly desirable for producing fired and chemically bonded basic brick. These brick are currently being used in reverberatory and open-hearth furnaces, in converters, and in electric furnaces in the copper, nickel, steel, and other metallurgical industries. As basic brick, they possess remarkable refractory and spalling resistant properties, particularly in furnaces that are operating at temperatures normally used. An initial trial of brucite brick in the roof of a large reverberatory furnace operating under unusual conditions has given satisfactory results.

Brown[10] discussed a deposit of brucite near Wilkinson, Ontario.

Cuba.—Magnesite was mined by numerous small, independent operators, mostly farmers, near Santa Clara, where it was caustic-calcined for export to Great Britain and the United States.

Manchuria.—One of the world's largest magnesite deposits is in an area of about 60 square kilometers in the Tashichia-Niushinshan Railway sector, according to Mineral Trade Notes, Confidential Series 14, August 1943 (p. 29). The main vein is about 100 kilometers in length, including certain breaks, and is up to several hundred meters in thickness; near Kuanmashan it is 700 meters thick. Reserves are estimated at 580,000,000 metric tons. A typical analysis is MgO 46.36, SiO_2 1.23, Fe_2O_3 0.46, Al_2O_3 0.41, and CaO 0.43 percent.

POST-WAR PROSPECTS FOR THE MAGNESITE INDUSTRY

Severe competition may be expected in post-war years in raw materials for magnesium metal and for basic refractories. Subsidized production, particularly in the magnesium-metal field, has necessarily cut through peacetime considerations of economic freight, cheapest raw material, and cheapest power available in favor of speed. The Truman Committee[11] has indicated that electrolysis of $MgCl_2 \cdot H_2O$ obtained from well brines is thus far the cheapest source of magnesium metal. Unless other reduction processes using magnesite, dolomite, and other raw materials are able to effect tremendous technologic economies so that their costs become comparable to those now used on well brines, they may be expected to close down or operate at a loss after the war.

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[9] Goudge, M. F., Brucite Magnesia: Jour. Am. Ceram. Soc., vol. 27, No. 1, January 1944, pp. 8–9.

[10] Brown, I. C., Brucite in Limestone near Wilkinson, Ont.: Econ. Geol., vol. 38, No. 5, August 1943, pp. 408–419.

The basic refractories industry is linked closely with conditions in the steel industry. If the production of basic open-hearth steel declines in the years immediately after World War II as it did after World War I, very little basic brick will be sold because few furnaces will be rebuilt for several years, and the consumption of maintenance-grade material will also be smaller. Post-war basic brick can and probably will be superior to wartime brick, as more high-grade synthetic magnesia will be available per brick. Chesters[12] believes that electrically fused magnesia shapes will be used in increasing quantities in ports and other positions in the furnace where conditions are particularly severe. Both mined and sea-water magnesia might compete in this market, although present practice appears to be limited to mined magnesite.

The necessity of making steel speedily regardless of cost will no longer be a controlling factor after the war. The wartime expedient of ramming proprietary magnesia and chrome mixtures to form the hearth bottom in 10 to 11 days instead of sintering in several layers of grain magnesite in 15½ to 16½ days will be reexamined in the light of ultimate costs.

Domestic producers of magnesite probably will not have to fear an overwhelming influx of foreign magnesite after World War II as they did after World War I, in view of the present tariff protection, which was first afforded the industry in 1922. The present tariff (Tariff Act of 1930) of $9.375 on crude, $18.75 on caustic-calcined, and $11.50 a short ton on dead-burned and periclase should hold imports from Austria, Greece, Manchuria, India, and other countries to pre-war volumes, or about 35 to 40 percent of domestic consumption. Tariff revisions might affect foreign trade profoundly.

Post-war years may bring forth the practicable all-basic furnace, which would reduce the cost of steel materially owing to the melting speed attainable at more elevated temperatures. In present practice the softening point of the silica roofs in basic furnaces limits the temperature to which the furnace may be exposed, and consequently a longer time is required to melt the batch. Research on such magnesia brick for basic roofs in large open hearths presumably will continue after the war and should eventually fructify.

DOLOMITE

Crushed dolomite, both raw and calcined, was used in increasing quantity as a basic open-hearth dressing and for routine furnace maintenance in 1943. Total sales of dead-burned dolomite are given in the following table.

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[11] Special [Truman] Committee Investigating the National Defense Program. Work cited in footnote 6.

[12] Chesters, J. H., Magnesite Refractories: Iron Age, vol. 151, No. 22, June 3, 1943, p. 50.

Commercial methods of extracting magnesium values from dolomite were reviewed in this chapter of the 1942 Minerals Yearbook.

The United States has been very fortunate in its supply of basic refractories in comparison with some of the other warring countries, notably Germany, which suffers from a shortage of chromite, and Great Britain, which lacks magnesite but has solved the shortage by a wider use of stabilized dolomite brick and grain and of serpentine-magnesia mixtures.[13]

Dead-burned dolomite sold in and imported into the United States, 1939–43

Year	Sales		Imports[1]		Year	Sales		Imports[1]	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1939	671,561	$5,447,554	186	$4,260	1942	1,229,357	$10,817,634	449	$11,260
1940	867,909	6,925,328	....	....	1943	1,276,725	11,243,017	739	22,563
1941	1,069,887	9,111,172	64	654					

[1] Reported as "dead-burned basic refractory material."

A British trade magazine[14] reports:

> Owing to scarcity of magnesite brick, basic industrial furnaces have turned to dolomite clinker, rammed hard, said to be superior to magnesite brick (which spalled badly), cost little more than half magnesite brick, and did not react with slag to build up as did magnesite and chrome brick.

In Britain refractory dolomite is stabilized by calcining it with serpentine, whereby the lime is converted to stable tricalcium silicate. According to Chesters[15]—

> It is considered safer to operate slightly on the silica rich side of this composition, which means that the brick contains a small amount of beta dicalcium silicate. Since this might otherwise invert, a small proportion of one or more of the known stabilizers is added to the batch.

This procedure differs from American practice, by which the lime is converted to dicalcium silicate with addition of stabilizing iron oxide. The American product softens at a lower temperature than the British on account of its content of the low-melting calcium ferrites, but this is no draw-back for maintenance use. In Britain, however, much stabilized dolomite must be sufficiently refractory for brickmaking; hence formulas are used which require as little stabilizer as possible.

Beta dicalcium silicate, the principal calcium compound in American stabilized dolomite, is unstable and tends to invert to gamma dicalcium silicate with 10-percent volume increase, a phenomenon known as "dusting." To prevent this inversion various stabilizers have been tried, including iron oxide and phosphoric oxide. Zerfoss and Davis[16] suggest that such stabilizers might work in two ways: (1) By isolation of grains of dicalcium silicate, thus interrupting the inversion wave and (2) by stabilizing the crystal lattice by introducing foreign substances.

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[13] Jackson, A., The Maintenance of Furnace Linings: Refract. Jour., vol. 19, No. 9, September 1943, pp. 303–304.

[14] Metallurgia, vol. 29, No. 170, December 1943, p. 61.

[15] Chesters, J. H., Dolomite Refractories: Iron Age, vol. 152, No. 6, August 5, 1943, p. 52.

[16] Zerfoss, S., and Davis, H. M., Observations on Solid-Phase Inversions of Calcium Orthosilicate, Constituent of Dolomite-Silica Brick: Jour. Am. Ceram. Soc., vol. 26, No. 9, September 1, 1943, pp. 302–307.

Seil and Schallis have reviewed in fairly comprehensive fashion methods for separating magnesia from dolomite.[17]

Other aspects of the dolomite industry are reviewed in the Stone chapter of this volume.

OTHER MAGNESIUM COMPOUNDS

The Bureau of Mines traditionally collects production data on "natural" magnesium salts, although in recent years the definition of "natural" has been enlarged to include magnesium hydroxide and magnesium chloride from raw sea water. In preparing magnesium hydroxide the hydroxide anion comes not from sea water but from lime, and in magnesium chloride the chloride anion comes not from raw sea water but from the electrolysis of salt. To obtain complete coverage, the Bureau of Mines now canvasses the magnesium chloride made from magnesite by Basic Magnesium, Inc., and from dolomite by International Minerals & Chemical Corporation, Mathieson Alkali Works, and Diamond Alkali Co., and such data are included with natural magnesium chloride crystallized from well brines. Virtually all magnesium chloride produced was reduced to metal in 1943.

On the other hand, only magnesium sulfate recovered from natural brines is reported, the data not including that made by neutralizing caustic-calcined magnesia with sulfuric acid solution. Magnesium sulfate is used in aqueous solution as a rayon coagulant, in tanning, in pharmaceuticals, as a fertilizer, and for other purposes.

The figures for precipitated magnesium carbonate include material derived from magnesite, dolomite, and well brines and consist mostly of basic carbonate for 85-percent magnesia insulation.

Magnesium compounds (other than magnesium oxide) sold or used by producers (exclusive of those used by producers in making other magnesium compounds) in the United States, 1942–43

Product	1942		1943	
	Short tons	Value	Short tons	Value
Precipitated magnesium carbonate	66,042	$5,596,698	63,900	$6,083,647
Magnesium chloride, 100-percent basis	[1] 210,000	7,468,518	646,136	45,858,183
Magnesium sulfate, 100-percent basis	[1] 20,200	1,029,662	26,416	1,320,104
Other	643	143,486	610	134,150
	296,885	14,238,364	737,062	53,396,084

[1] Figures recorded in chapter of this series for 1942 calculated to basis of 100 percent.

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[17] Seil, G. E., and staff, Study of Literature on Separation of Magnesia from Lime in Dolomite and Similar Materials: Jour. Am. Ceram. Soc., vol. 26, No. 7, July 1943, pp. 218–238.

Schallis, Alvin, Economic Considerations in the Recovery of Magnesia from Dolomite. Bureau of Mines Inf. Circ. 7247, 1943, 53 pp.

Magnesium compounds imported for consumption in the United States, 1939–43

Year	Magnesium chloride (anhydrous and n. s. p. f.)		Magnesium sulfate (Epsom salts)		Calcined magnesium sulfate or calcined kieserite (not fertilizer)		Oxide or calcined magnesia		Magnesium carbonate, precipitated		Magnesium salts and compounds, n. s. p. f.[1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	28	$960	198	$3,641	2,472	$43,435	38	$14,755	776	$68,934	59	$26,788
1940	([2])	21	6	898	....	....	18	5,672	754	82,764	92	44,492
1941	28	1,328	1	179	....	....	12	4,292	1,106	113,236	23	11,488
1942	186	115,025	....	....	....	....	16	5,487	640	70,756	13	6,701
1943	....	....	....	....	....	....	....	....	122	17,730	6	6,181

[1] Magnesium silicofluoride or fluosilicate included under "Magnesium salts and compounds, n. s. p. f."
[2] 109 pounds.

Part II.—MISCELLANEOUS SALINES

CALCIUM CHLORIDE

Despite labor shortages for rural road work, sales of natural calcium chloride (and calcium-magnesium chloride) were well-maintained in 1943, reaching 199,796 short tons (75-percent basis) valued at $1,549,565 compared with 224,527 tons valued at $1,733,169 in 1942. There were 11 producers in 1943 and 13 in 1942.

Calcium chloride is derived chiefly from three sources—sea-water bitterns, well brines, and byproduct liquors of the ammonia-soda process. Producers of the last material are not canvassed by the Bureau of Mines, but sales were estimated at 180,000 tons in 1943 compared with 175,000 in 1942. Probably 90 percent of the total calcium chloride available from all sources is thrown away. The amount recovered depends on the market from year to year.

The following firms reported production of calcium chloride (and calcium-magnesium chloride) from natural brines in 1943: California Rock Salt Co., 2436 Hunter Street, Los Angeles 21, Calif., plant at Amboy, Calif.; J. Q. Dickinson & Co., Malden, W. Va.; The Dow Chemical Co., Midland, Mich.; Hill Brothers Chemical Co., 2159 Bay Street, Los Angeles 21, Calif., plant at Amboy, Calif.; Liverpool Salt Co., Hartford, W. Va.; Michigan Chemical Corporation, St. Louis, Mich.; Ohio River Salt Corporation, Mason, W. Va.; Pomeroy Salt Corporation, Pomeroy, Ohio, plant at Minersville, Ohio; Rademaker Chemical Corporation, Eastlake, Mich.; and Westvaco Chlorine Products Corporation, 405 Lexington Avenue, New York 17, N. Y., plants at Chula Vista, Calif., and South Charleston, W. Va.

Calcium chloride and calcium-magnesium chloride from natural brines sold by producers in the United States, 1939–43

[In terms of 75 percent (Ca, Mg) Cl_2]

Year	Short tons	Value	Year	Short tons	Value
1939	108,441	$1,307,717	1942	224,527	$1,733,169
1940	99,536	998,241	1943	199,796	1,549,565
1941	165,932	1,333,370			

Calcium chloride imported for consumption in and exported from the United States, 1939–43

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1939	996	$12,314	19,382	$318,199
1940	----------	----------	8,907	194,738
1941	7	795	20,777	511,366
1942	1,443	18,926	8,336	223,184
1943	8,000	102,080	12,725	434,933

Road stabilization generally uses about half the total calcium chloride consumed. Surfacing of airfields and roads in military camps at home and overseas has also stimulated demand. For example, the salt was used in stabilizing rolled sand fill on the Adak airfield in the Aleutians campaign.[18]

Most uses of calcium chloride depend either on its hygroscopic properties or the low freezing point of its solutions. Such uses include air conditioning, freeze-proofing of coal and ores, concrete curing, and many others. Chemically, calcium chloride is used to extract lithium chloride from spodumene by heating and to make calcium-soap lubricants. Postponed roadwork and construction are expected to provide a good market for calcium chloride in post-war years.

Prices of calcium chloride, according to the Oil, Paint and Drug Reporter, were the same as in 1942, with the exception noted below: Flake, 77 to 80 percent, carlots, delivered, $18.50 to $35.00 according to zone; solid, 73 to 75 percent, $18.00 to $31.50 ($34.50 in 1942) a ton, carlots, delivered; and 40-percent solutions, $7.50 a ton, tank cars, works.

BROMINE

Producers' sales of bromine compounds established a record in 1943—94,085,937 pounds of contained bromine valued at $19,107,065 compared with 65,880,935 pounds valued at $13,729,383 in 1942. The actual quantity of compounds was 111,205,096 pounds in 1943; comparable figures for earlier years are not available. There were 14 producers in 1943, the same 14 as in 1942. Most bromine enters the market as ethylene dibromide, an antiknock assister. The increasing tempo of the war has multiplied demands for motor fuels, and the growing output of high-octane gasoline has increased rather than diminished the need for antiknock fluids. Nearly all the ethylene dibromide used is made by the Ethyl-Dow Chemical Co. at Wilmington, N. C., and Freeport, Tex., from raw sea water, and the Dow Chemical Co. at Midland, Mich., from well brines. The Ethyl-Dow Chemical Co. began the construction of additional plant capacity at Wilmington, N. C., and Freeport, Tex., to meet the even heavier demands anticipated during 1944. Other bromine compounds, both organic and inorganic, are made by the following firms from sea-water bitterns, dry-lake brines, and well brines: American Potash &

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[18] Richardson, H. W., Journey to Attu and Back: Eng. News Record, vol. 131, No. 16, October 14, 1943, p. 4.

Chemical Corporation, Trona, Calif.; J. Q. Dickinson & Co., Malden, W. Va.; The Dow Chemical Co., Midland, Mich.; Great Lakes Chemical Corporation, Filer City, Mich.; Liverpool Salt Co., Hartford, W. Va.; Michigan Chemical Corporation, St. Louis, Mich.; Morton Salt Co., Manistee, Mich.; Pomeroy Salt Corporation, Minersville, Ohio; Rademaker Chemical Corporation, Eastlake, Mich.; and Westvaco Chlorine Products Corporation, South Charleston, W. Va., and Chula Vista and Newark, Calif.

Bromine and bromine in compounds sold or used by producers in the United States, 1939–43

Year	Pounds	Value	Year	Pounds	Value
1939	37,882,005	$7,611,400	1942	65,880,935	$13,729,383
1940	59,266,275	11,772,515	1943	94,085,937	19,107,065
1941	68,317,019	11,506,213			

In addition to antiknock fluids, bromine is used in making fumigants, dyes, medicinals, and photographic reagents. Nearly all prices of bromine compounds in 1943 were identical with those in 1942. Ethylene dibromide was quoted over a range of 65 to 70 cents a pound during 1943, f. o. b. plant. Potassium bromide, National Formulary grade, granular, was quoted at 27 to 31 cents a pound; sodium bromide, same grade, was 27 to 30 cents (27 to 31 cents in 1942). Bottled elemental bromine in cases was 25 to 30 cents a pound.

The post-war outlook for bromine production appears good, owing to the direct connection with consumption of automobile and aviation gasolines.

IODINE

Production of iodine increased again in 1943, establishing a new record. There are only two producers—Dow Chemical Co. and Deepwater Chemical Co., Ltd.—and for this reason production data may not be published. In the last year in which three producers operated (1937), output of iodine was 299,286 pounds valued at $242,422. Production has been much higher in recent years, particularly during the war.

Domestic iodine is obtained from oil-well waste waters at Compton, Calif.; the iodine content is estimated at about 45,655 pounds per million gallons of water. Also, considerable iodine is imported from Chile, where it is obtained as a byproduct from caliche. At the end of the year large stocks were being carried by the Chile Nitrate Sales Corporation (about 1,000 tons), and stocks in consumers' warehouses were abnormally large.

The main and best-known use of iodine is as a disinfectant; but its salts have other medicinal and industrial uses, especially in photography, analytical chemistry, and foodstuffs for men and stock.

The price of iodine in 1943 was the same as in 1942, $1.35 a pound less 5 percent, in 150-pound kegs. Resublimed iodine in 5-pound bottles, 50-pound lots, sold at $2 a pound during the year. Virtually all imports were from Chile, as usual.

Crude iodine imported for consumption in the United States, 1939–43

Year	Pounds	Value	Year	Pounds	Value
1939	200,000	$168,238	1942	951,243	$1,051 432
1940	1,244.146	1,296,181	1943	2,744,930	3 041.609
1941	1,010,039	1,121,513			

Considerable current information on iodine and its uses is published in Iodine Facts, available from the Iodine Educational Bureau, Stone House, Bishopsgate, London, E. C. 2.

SODIUM SULFATES AND CARBONATES

Production of natural sodium sulfate in 1943 was handicapped by labor shortages and was 5 percent less than in 1942. On the other hand, production of natural sodium carbonate (all in California), in a vain attempt to meet west coast demands, established a new record, increasing 10 percent in quantity over 1942.

The American Potash & Chemical Corporation completed two expansions in its Soda Products plant at Trona, Calif., for the separation of sodium sulfate and sodium carbonate in the double salt, burkeite. The Arizona Chemical Co., 30 Rockefeller Plaza, New York City, produced sodium sulfate from well brines at O'Donnell and Brownfield, Tex., for the sulfate pulp market but experienced considerable production difficulties owing to the labor shortage. The Cartago Co., 8317 Beverly Boulevard, Los Angeles 36, Calif., shipped trona produced 10 years ago from Owens Lake by the Inyo Chemical Co. but never sold. The Desert Chemical Co., 4031 Goodwin Avenue, Los Angeles, Calif., extracted sodium sulfate from well brines at its Dale Lake plant near Twentynine Palms, Calif. With additional plant capacity completed in 1942, it nearly trebled its sales of sodium sulfate. The Iowa Soda Products Co., Council Bluffs, Iowa (plant at Rawlins, Wyo.), continued its production of Glauber's salt for stock feed.

Natural sodium sulfates and sodium carbonates sold or used by producers in the United States, 1935–43

Year	Sodium sulfates[1]		Sodium carbonates[2]	
	Short tons	Value	Short tons	Value
1935	38,706	$275,943	93,230	$1,173.003
1936	51,608	336,559	102,866	1,106.364
1937	80,053	599.266	104,711	1,191.485
1938	80,210	596,812	100,010	1,235.328
1939	137,479	1,027,876	124,743	1.528,810
1940	187,233	1.528,633	130,034	1.629,283
1941	157,524	1,443,137	146,677	1,822.986
1942	175,033	1,669,983	150,619	2,145,289
1943	165,908	1,553,549	165,993	2,544,086

[1] 1935–38 and 1943: Salt cake and Glauber's salt; 1939–42: Salt cake, Glauber's salt, and burkeite.
[2] 1935–41: Soda ash, bicarbonate, and trona; 1942–43: Soda ash and trona.

The Natural Soda Products Co., 405 Montgomery Street, San Francisco, recovered sodium carbonate at Keeler, Calif., from Owens Lake, Inyo County. The company no longer precipitates sodium bicarbonate as the first raw material; but with the aid of flue gases it carbonates further to the sesquicarbonate, which is precipitated, calcined, pugged, and recalcined to yield a dense soda ash. Owens Lake became a profitable source of natural salts when the city of Los Angeles diverted the flow of Owens River from the lake via an aqueduct in 1915, permitting the lake to evaporate. During the period 1937–39 the city of Los Angeles flooded the lake by returning part of the flow of Owens River, and operations there were seriously curtailed until the lake evaporated once more in 1941. The question of whether the city of Los Angeles has the right to flood the lake is pending before the courts and may determine the future of the two firms operating at Owens Lake.[19]

The Ozark Chemical Co., Mid-Continent Building, Tulsa, Okla., recovered sodium sulfate at its Monahans (Tex.) plant, mostly for sale to sulfate pulp processors. The Pacific Alkali Co., 523 West Sixth Street, Los Angeles (plant at Bartlett, Calif.), extracted soda ash and trona from Owens Lake brines for use in mining and metallurgy, cleansers, and glass. W. E. Pratt, Casper, Wyo., mined sodium sulfate near Casper and converted it to Glauber's salt for stock feed. The West End Chemical Co., 608 Latham Square Building, Oakland, Calif., increased its production of sodium carbonate from Searles Lake.

The principal uses of sodium sulfate are in the manufacture of kraft pulp by the sulfate process, glass, and stock feeds, in dye standardization, and as a flux in metallurgy.

The four producers of natural sodium carbonate in California were unable to supply west coast requirements in 1943, and substantial quantities were shipped in by rail from eastern alkali manufacturers at somewhat higher cost. Sodium carbonate is used chiefly on the west coast in glass manufacture and cleansers. Substantial quantities are used in nonferrous metallurgy and as a precipitant of magnesium carbonate from sea-water bitterns. The post-war outlook for the industry appears good if water-transport rates to the west coast via the Panama Canal do not become so low as to permit competition with eastern producers.

Production data for sodium carbonate produced by the ammonia-soda process for the last 3 years, according to the Bureau of the Census, are: 1941, 3,606,826 short tons; 1942, 3,788,583; and 1943, 4,407,618. There are no official consumption figures for sodium carbonate, but the following table, published in Chemical and Metallurgical Engineering, may be indicative.

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[19] Pacific Reports 2d, vol. 132, January 1943, p. 553.

Estimated consumption of sodium carbonate in the United States, 1940–43, by industries, in short tons[1]

Industry	1940	1941	1942	1943
Glass	860,000	990,000	1,100,000	1,200,000
Soap	200,000	170,000	165,000	150,000
Caustic and bicarbonate	780,000	1,033,000	960,000	1,010,000
Other chemicals	730,000	800,000	840,000	950,000
Cleansers and modified sodas	65,000	70,000	80,000	85,000
Pulp and paper	123,000	155,000	145,000	155,000
Water softeners	55,000	70,000	80,000	95,000
Petroleum refining	20,000	23,000	18,000	20,000
Textiles	45,000	60,000	56,000	58,000
Nonferrous metallurgy	248,000	150,000	260,000	450,000
Miscellaneous		225,000	230,000	370,000
	3,126,000	3,746,000	3,934,000	4,543,000

[1] 1940: Chem. and Met. Eng., vol. 50, No. 2, February 1943, p. 105; 1941–43: Chem. and Met. Eng., vol. 51, No. 2, February 1944, p. 113.

Domestic salt cake was quoted at $15 a short ton, bulk, works; anhydrous sodium sulfate at $1.70 to $1.90 per hundredweight, works; and Glauber's salt at $1.05 to $1.25 per hundredweight in 1943, according to the Oil, Paint and Drug Reporter. Soda ash, calcined sodium carbonate, was sold at $0.90 to $3.25 a hundredweight, depending on grade and other factors.

Sodium metal.—There are only two domestic producers of sodium metal—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and Ethyl Gasoline Corporation, 405 Lexington Avenue, New York City—and therefore production data may not be published. Sodium metal is made by electrolysis of fused salt, NaCl. About half the output is used in making tetraethyl lead (the gasoline antiknock), and most of the other half is used in the synthesis of dyes and other organic chemicals. Some is used as a metal in alloys, as a scavenger, and in the liquid phase as a heat-transfer medium. Sodium is available in tank cars or in 2½- or 12-pound bricks packed in drums. Metallic sodium was placed under allocation November 15, 1943, to assure adequate supplies for the manufacture of tetraethyl lead.

BORATES

Production of boron minerals in 1943 recovered from the 1942 slump and has been exceeded only by the output of 1941. Five producers, all in California, reported shipments—the same five firms that produced in 1942.

American Potash & Chemical Corporation, 122 East Forty-second Street, New York City, extracted borax from the brines of Searles Lake at its Trona (Calif.) plant and sold borax, dehydrated borax, and boric acid for domestic and foreign consumption in a wide variety of uses, but principally in glass. The brine is pumped from wells approximately 70 feet below the crust of the lake and transmitted via pipe line to the plant 4 miles away. Pacific Alkali Co., 1223 Pacific Mutual Building, Los Angeles, recovered borax from the brines of Owens Lake at Bartlett, Calif., chiefly for export.

Pacific Coast Borax Co., the oldest and one of the largest producers, operated its kernite mines at Boron, Calif., and its Wilmington (Calif.) refinery (making over 200 boron derivatives, including kernite concentrates, borax, and boric acid) for domestic and export trade.

Connell[20] reviewed the mining and processing of kernite by the Pacific Coast Borax Co. Kernite is mined by the shrinkage-stoping and room-and-pillar methods from the Baker deposit at Boron near Mojave; shipped to a refinery at Wilmington, Calif., on the coast; dissolved in water with the aid of heat and pressure; and reprecipitated as sodium tetraborate, or borax.

United States Borax Co., 510 West Sixth Street, Los Angeles, mined colemanite (crude calcium borate) near Shoshone, Inyo County, Calif., for conversion into borax at a nearby refinery.

West End Chemical Co., 608 Latham Square Building, Oakland, Calif., recovered borax from Searles Lake at its Westend (Calif.) plant and sold both borax and dehydrated borax.

Salient statistics of the boron-mineral industry in the United States, 1939–43

	1939	1940	1941	1942	1943
Sold or used by producers: [1]					
Short tons:					
Gross weight	245, 284	243, 355	301, 282	226, 723	256, 633
B_2O_3 content	81, 800	80, 900	95, 200	77, 600	87, 600
Value	$5, 689, 797	$5, 643, 390	$6, 785, 662	$5, 733, 648	$6, 401, 507
Imports for consumption (refined): [2]					
Pounds	[2] 774	752	2, 025	------------	------------
Value	[2] $170	$185	$92	------------	------------
Exports:					
Short tons	91, 139	64, 313	41, 793	36, 542	26, 877
Value	$3, 230, 304	$2, 456, 523	$1, 893, 500	$1, 562, 794	$1, 282, 372
Apparent consumption: [3]					
Short tons	154, 145	179, 042	259, 490	190, 181	229, 756

[1] 1939: Borax, colemanite, kernite, ulexite, and boric acid; 1940–41: Borax, kernite, boric acid, and colemanite; 1942–43: Borax, anhydrous sodium tetraborate, kernite, boric acid, and colemanite.

[2] Also 348 pounds of crude valued at $7 in 1939; 525 pounds of crude valued at $7 in 1943.

[3] Quantity sold or used by producers plus imports minus exports.

The price of technical borax, granular, bulk, freight allowed, remained at $41.50 a short ton throughout 1943, the same as in 1942, according to E&MJ Metal and Mineral Markets.

Owing to the fact that producers report the quantities and values of their boron products at various stages in the process of refining (ranging from crude ore to finished salts and boric acid) it has been decided to add an entry in the boron minerals salient statistics table indicating the B_2O_3 content of all ores and salts produced.

Container glass is today using most of the output of boron minerals, according to producers' estimates. Borax in the glass batch enables glass to withstand, with minimum breakage, treatments such as washing and pasteurizing; and borax improves the tensile strength, elasticity, and hardness of glass, thus facilitating handling and shipping. In normal times the chief use of borax is in porcelain enamels, but this market must remain quiescent until steel is again generally available for stoves, refrigerators, kitchen utensils, and similar articles.

Boron compounds are used in water treatment, soap formulas, pharmaceuticals, alloy steels, flame-resisting paints, fertilizers, and various other commodities.

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[20] Connell, George A., Technology of Borax Production as Practiced by the Pacific Coast Borax Co.: Paper delivered at Am. Chem. Soc., One Hundred Sixth Meeting, Pittsburgh, Pa., September 6–10, 1943, and available from the Pacific Coast Borax Co., 51 Madison Ave., New York, N. Y.

Two new improved optical glasses made without sand and using boric acid have been announced. In addition to boric acid, the first of these glasses employs zinc oxide, alumina, and beryllia; and the second, oxides of tantalum, tungsten, and lanthanum.[21]

The New Jersey Zinc Co., 160 Front Street, New York, announced a zinc borate paint for flameproofing fabrics, tents, lifeboat coverings, and hatches.

The American Potash Institute, Inc., 1155 Sixteenth Street NW., Washington, D. C., issues frequent bibliographies on the use of boron fertilizers, as a series known as "List of References to Boron Literature." Published in 1943 were B–25, January–March; B–26, April–June; and B–27, July–September.

With the exception of small quantities of boron minerals produced in Italy, Turkey, Tibet, and certain South American countries, the United States has been virtually the world's supplier in recent years, and a considerable proportion of American production is exported in normal times. Reopening of foreign markets after the war should go far in absorbing material diverted to war uses at present.

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[21] Chemical Age, vol. 49, No. 1259, August 14, 1943, p. 157.

GEM STONES

By Sydney H. Ball

SUMMARY OUTLINE

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JEWELRY INDUSTRY IN 1943

Retail jewelers have never had a year like 1943. Sales of taxable jewelry totaled $998,094,416, or 26 percent above those in 1942 ($792,000,000). Gains over 1942 reached their peak in the second quarter of the year, then tapered off. The causes were an all-time high national income ($142,000,000,000, compared with $115,500,000,000 in 1942); a large number of weddings (1,725,000—only exceeded by the 1,800,000 in 1942); reduced competition from other luxuries and semiluxuries; and much money in the hands of free-spending warworkers. The increased sales were without Government stimulation. All men of draft age in the industry were nondeferable under the Selective Service System, and the 10-percent excise tax on jewelry sales was effective throughout the year.

Christmas sales were 20 percent larger than in the previous year and began as early as late September, so that our boys (and girls) overseas would get their gifts by Christmas. Gold jewelry, diamonds, costume jewelry, and Swiss watches were in particular demand.

Sales were largely of medium-price articles, although both retailers and art galleries disposed of a number of items running into five figures.

Manufacturing jewelers, with their supplies of metal markedly restricted by Government regulations, continued to make what jewelry they could, although the industry was converted, where possible, to war work. Their sales early in the year were large, although less than those of retailers. By August, however, sales slipped below those of 1942, and stocks decreased. Wholesalers began to sell from stocks accumulated in a happier day.

Luckily, now that the Office of Price Administration has removed price control from all diamonds, the black market in these gems has evaporated. The recently increased excise tax on all jewelry (from

10 to 20 percent, effective April 1, 1944) will scarcely increase the tax collected, as it is likely to cut down on gross sales and may create a black market, for certain of the smaller refugee "merchants" will sell without charging the tax. L-45 (Karat-Gold Limitation Order) has created a black market in carat-gold goods, particularly in wedding rings. It centers in New York. Some of the skilled workmen of the industry have left their former employers and work for fly-by-night shops or work overtime in them. Such shops have no difficulty in getting, at a price, the gold and the modicum of copper required. Low-carat gold rings and some electroplated silver rings are being sold surreptitiously as 14-carat rings.

On January 15, 1944, the War Production Board announced that approximately 50 percent more gold and palladium could be used by jewelers in 1944 than in the latter half of 1943. This liberalization of L-45 will retard the growth of the black market but is not sufficient to crush it.

A year or two hence—unless in the meantime peace is declared—the position of most retailers is not likely to be enviable. In 1943 most jewelers sold their accumulated stock, and adequate replacement is difficult or impossible; further, competent help is hard to find. Perhaps the less-aggressive sales attitude which the British retailers have adopted—namely, sell only that which can be replaced—is to be preferred. Present profits subject to current high tax rates are less desirable than having a going concern when the war ends. More retailers should specialize in diamonds, and they should replenish their stocks from heirloom jewelry. Some few retailers have shut up shop; others are shortening store hours appreciably.

POST-WAR PROSPECTS

As to the post-war outlook, competition within the retail trade will be keen, but reconversion of the jewelry trade should require less time than that of most other industries, and jewelers should be in an advantageous position compared with most of their competitors in being able early to extract from ex-warworkers some of their accumulated savings. Within the industry there will presumably be more competition from department stores, upstairs distributors, and door-to-door solicitors, because medium-price articles are likely to make up a larger percentage of the gross than formerly.

FASHIONS IN JEWELS

Jewelry was never more popular than in 1943 among American women who realize that beautiful jewelry, appropriately worn, may increase the charm of a smart gown. The vogue for gold, often in two or three tints, continued to grow, and more silver was used than ever. Diamonds still show to best advantage when set in white metal. Palladium, the substitute now used for platinum, is so light that it is ideal for earrings, and palladium pins do not "pull down" flimsy textiles. Floral designs and patriotic motifs were particularly popular, followed by geometric, leaf, and Latin-American and Chinese designs. Bizarre insects, animals, and dwarfs were common, particularly in cheaper jewelry. Multiple-use clips and other double-duty jewelry and ensembles, all mounted with the same gem, were widely used. Earrings and clips were much worn, bracelets and necklaces to a less extent.

Owing to a shortage of small cut, fewer melee were used in mountings. Huge topaz and aquamarine were mounted in bracelets and bridge rings. Diamond, ruby, and sapphire (the vogue for varied-colored sapphires is expanding) led in popularity, followed by natural and cultured pearl, emerald, topaz and topaz quartz, aquamarine, and moonstone. The insistent demand for diamonds, together with the patriotic motif in jewelry, caused colorless, then red and blue stones to be dominant, followed by green and yellow, and then purple and black stones.

American knowledge of precious stones continues to expand, and American women today use effectively three or four times as many varieties as did their mothers. High school and college girls love their jewelry, and turquoise and pearl are particularly popular with them.

DOMESTIC PRODUCTION

The production of gem stones throughout the world was blighted in 1943 by war, but nowhere more than on the North American Continent, which has no gem field of prime importance. In 1942 a rough estimate of the value of uncut stones used in jewelry and related industries was $150,000; in 1943, it was not over $67,000. The decrease was due to three principal factors: Professional gem miners turned to the mining of one or more of the strategic minerals; amateur collectors did not have enough gasoline (or tires) to rush out over the week-end to well-known mineral deposits; and the best customers of the trade, touring automobilists, were, for the same reason, a tradition. The increased mining of pegmatite bodies for mica and other strategic minerals apparently did not increase the production of beryl and other gems of pegmatite origin; perhaps the miners high-graded these. As opposed to gem miners, professional and semiprofessional lapidaries in the Northwest were busy furnishing jewelers with cabochon quartzes and agates, cut from stones collected in previous years, to supplant the European cheap jewelry which was no longer available. In the East, several firms are dyeing onyx black to be used in cheap jewelry.

As producers, the leading States ranked as follows: Montana, California, Wyoming, Oregon, Washington, Colorado, and Idaho.

The Montana sapphire industry produced about 20,000 ounces of sapphire worth some $20,000. The Perry-Schroeder Mining Co. of Helena was the principal producer. Charles H. Carpp of Philipsburg was also a producer. Although a small part of the product was of gem grade, practically all of it was sold for cutting into watch and instrument jewels. Toward the end of the year, synthetic corundum undercut the natural market badly.

The agate and other quartz species in 1943 were of the same order of value produced as sapphire. Dr. H. C. Dake reports that production, even at well-known localities in Washington and Oregon, was greatly reduced from that of previous years. Idaho's production decreased also.

The moss agate in the gravels of Yellowstone River in Montana continues to be collected, but to a smaller extent than in previous years. The collectors bring these to the two principal cutting and curio shops in Billings. After splitting the pebbles, the shops buy what small percentage they fancy.

Perhaps $15,000 worth of Wyoming jade was sold in 1943. Nephrite occurs mainly as boulders and pebbles, some of them large, on the hill slopes near Lander. It also occurs in place. The better material, green translucent nephrite, brings as much as $5 a pound, although the 4,000 pounds sold to lapidaries brought but $3 a pound. Several large boulders, one weighing over 8,000 pounds, were found in 1943. A boulder weighing 2,410 pounds and polished on one side is now on exhibition at the Chicago Natural History Museum. Some of the material is being stocked, in the hope of selling it to China after the war to be cut into objets d'art. All the Lander material is nephrite.

Turquoise production languished. The King and Ashcroft mines in Colorado produced turquoise in 1943, although the Hall mine (principal producer in 1942) did not operate. It is stated that the Mineral Park (Ariz.) district produced some turquoise, as did certain deposits in western New Mexico. The manufacturers of Indian jewelry, however, look to Nevada and Colorado for their turquoise, although there is no evidence at hand that the Nevada mines operated in 1943. A turquoise deposit in Culberson County, Tex., is being developed.

Alfred M. Buranek reports that some good plume agate was collected at Jericho, Juab County, Utah, as was fortification agate at the new locality in Sanpete County near Levan; that some 500 pounds of fine variscite was mined at Lucin; that some superb malachite and azurite were recovered from the Dixie Apex mine near St. George; that the black obsidian with white christobalites found near Black Creek (trade names, Flowering Obsidian, Night Blooming Cereus, and Snowflake Obsidian) is increasing in popularity; and that Utah Jade, fabricated into book ends, table tops, and other articles, is merely a quartzite of the Harrison formation of pre-Cambrian age colored by chrome-bearing mica.

Stuart A. Northrop states that some attractive "moonstone" (presumably sanidine) appears to be coming from Grant County, N. Mex., and that during the year there was a small demand for garnets from the Navajo Reservation, staurolites from Taos County, and agate from near Hot Springs, Sierra County.

Stanley I. Perham reports among other gem stones found in Maine during the year: Purple apatite at Greenwood, Oxford County; beryl approaching a light emerald in color and golden beryl from West Peru; fine golden beryl from Waterford and Brunswick; white caesium beryl and rose quartz at Newry; and aquamarine and asteriated rose quartz from Albany.

Little pipestone (only about 1,000 pounds) was mined at Pipestone, Minn., as most of the former diggers are in the army.

Scott's Rose Quartz Co. (South Dakota) reports the sale of about 800 pounds of rose quartz, although little was mined because of the labor shortage.

Edward P. Henderson reports that the National Museum has an 18.7-carat brilliant cut from transparent scheelite from Kernville, Kern County, Calif. The stone has good brilliancy although a bit frosty, and makes quite an attractive gem.

Quartz for use in radios and radar equipment was mined in California, Arkansas, and North Carolina. The usability of American quartz is low, but some of it may be suitable for objets d'art.

A few small diamonds were recovered at Murfreesboro, Ark. (see Diamond—World production).

Other gems produced in the United States in 1943 included agate (Maine); aquamarine (Maine, North Carolina, and Virginia); bloodstone (San Bernardino County, Calif.); chrysocolla (Arizona); golden beryl (Virginia); jasper (Maine); banded "onyx" (calcite) (Lusk, Wyo.); malachite (Arizona); petrified wood (Arizona); pink beryl and tourmaline (Pala district, Calif.); and smoky quartz (Maine).

CANADIAN GEM STONES

A small amount of clear, glassy beryl from the Winnipeg River and Bird River pegmatite areas in Manitoba is cut for the Winnipeg tourist jewelry trade. Dr. A. L. Parsons reports that excellent rock crystal has been found in Lansdowne Township, Ontario, and a little iolite in Haliburton Township. Both localities furnish material for amateur lapidaries.

IMPORTS [1]

The value of imports of precious and semiprecious (real and imitation) stones (exclusive of industrial diamonds) totaled $72,109,788, over two and one-half times that of 1942. The big increase was in the importation of rough and cut diamonds and cut precious stones. Details are as follows:

Precious and semiprecious stones (exclusive of industrial diamonds) imported for consumption in the United States, 1942–43

Commodity	1942		1943	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty free	278,437	$11,546,712	751,674	$37,443,240
Cut but unset, suitable for jewelry, dutiable	126,004	14,640,236	193,701	31,453,840
Emeralds:				
Rough or uncut, free	6,506	676	8	248
Cut but not set, dutiable	21,209	205,717	3,194	32,508
Pearls and parts, not strung or set, dutiable:				
Natural	----------	179,169	----------	167,284
Cultured or cultivated	----------	----------	----------	107
Other precious and semiprecious stones:				
Rough or uncut, free	----------	72,895	----------	47,726
Cut but not set, dutiable	----------	1,583,600	----------	2,589,904
Imitation, except opaque, dutiable:				
Not cut or faceted	----------	195	----------	2,621
Cut or faceted:				
Synthetic	----------	87,062	----------	167,166
Other	----------	97,857	----------	100,841
Imitation, opaque, including imitation pearls, dutiable	----------	2,622	----------	8,149
Marcasites, dutiable:				
Real	----------	101,785	----------	96,154
Imitation	----------	1,544	----------	----------
	----------	28,520,070	----------	72,109,788

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[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

GOVERNMENT REGULATIONS

Owing to the war, Government regulations covering the jewelry industry and originating in 1943 were legion. Many were primarily to raise revenue and to discourage luxury spending (for example, the 100-percent tax on jewelry sales in Great Britain); others to conserve labor or to control the supplies of valuable metals; others to prevent the export of easily converted wealth; and still others to protect home industries (for example, to protect its precious stone industry, Brazil requires a permit, difficult to obtain, to import synthetic stones).

In Germany all shops selling jewelry were closed in February, and jewelry manufacture was prohibited after April 1. In all, 3,300 shops were closed, the blow of course falling most heavily on middle class proprietors. German war prisoners in Canada, remembering what happened to the mark after World War I, are buying plain gold rings.

The Nazis closed jewelry shops in the Netherlands in March. The Germans continue to buy any fine jewels they can in the Netherlands black market, even if the prices are exorbitant. On September 29, the Nazi-controlled Department of Commerce decreed that pearls, rubies, sapphires, and emeralds could be bought only against surrender of ration coupons. Precious stones were one of the few means left for the Netherlanders to invest money. The decree will force such excess money into the Netherlands Bank, where the Nazis can confiscate it.

EFFECT OF WAR ON GEM-STONE TRADE

War continues to change the picture of the gem trade; for example, the recent reopening of the Dutoitspan pipe is a direct result of the tremendous fall in world diamond stocks due to war's insatiable demand for industrial diamonds and the large demand for gem diamonds. We are, on the other hand, cut off from the ruby and sapphire fields of Burma and Thailand; the Burmese jade fields are languishing because China, their main market, is no longer open to them; and the Badakshan lapis lazuli mines have lost their former market, Germany.

Our boys overseas are matching their wits with those of local jewelers of many lands. Ceylon's precious stones have mounted in price, and not only are jewel brokers bidding for them, but our boys are getting their part there as well as in India. Our soldiers have already purchased most of the lovely old silver jewelry in the Algerian shops; Italians are now attempting to foist flimsy trinkets on them as fine heirlooms.

Our domestic production of gem stones is down, since professional mines are mining strategic minerals, and amateurs have neither the tires nor the gas to seek them. Similarly, in Brazil accelerated quartz and mica mining draws from the same pool of labor as diamond and other gem-stone mining, and in consequence the production of the latter two is affected adversely.

In Great Britain, wedding rings are so scarce that some brides use their grandmothers' or mothers' rings. The production quota of 9-carat utility rings has been increased, and many brides are reluctantly accepting them rather than the better rings they hoped to wear. South African brides refuse to accept them.

War has brought about important (though possibly temporary) geographic adjustments in various branches of the jewelry industry. The wide dispersal of the cutting of gem diamonds is an instance in point. Argentina is making the cheap jewelry which it once imported and even exports some of it. Great Britain and the United States now produce synthetic sapphire and ruby, and after the war these will be used for jewelry. Czechoslovak refugees in each country are making fine colored glasses to be used as imitation precious stones.

One of the few humorous incidents of the war is the fact that our boys find that the South Pacific island natives will do nothing for money but are enchanted to work hard for second-hand "junk" jewelry. Tons are being collected and sent to the Pacific isles.

DIAMOND

Paradoxical as it seems, in 1943—the fifth year of World War II—the diamond industry reached an all-time peak of prosperity, owing to an unprecedented demand for industrial stones and an enormous demand for gem diamonds created by high war wages and fear of inflation.

Production continued downward, that of 1943 being but 88 percent of the 1942 output and only 63 percent of the production in 1940. The war demand has dangerously reduced the large stocks of both industrials and gem stones accumulated in the past 16 years; in consequence, the United Nations have requested the Belgian Congo to double its production of crushing bort, and DeBeers has reopened Dutoitspan, one of its pipe mines. Diamond cutting continued to increase.

Price of gem stones, both rough and cut, surged forward; that of industrial stones continued stable, although sellers of industrial stones claim that the quality of the shipments had deteriorated, amounting to a price rise.

The division between diamonds used for industrial purposes and those used ornamentally is yearly becoming more sharply defined.

Share dealings.—The shares of diamond-mining companies, virtually all of which are listed on the London Stock Exchange, were market leaders and doubled in value in 1943, accentuating their rise in the past 2 years. Indeed, one who had put $1,000 in these shares in mid-1941 would have a value on paper of $4,500 by mid-1943. The 1943 advance culminated late in June; thereafter the market weakened a bit. The companies paid generous dividends in 1943.

Market.—In 1943 the Diamond Trading Co., which in normal times sells about 95 percent of the world output, is said to have sold almost £20,000,000 worth of rough (£10,694,671 in 1942), the highest sales since 1919. Sales of both cuttables and industrials gained. The company instituted the practice of selling crushing bort by the kilogram, although American brokers continue to use the carat.

In 1943 the United States bought large quantities of medium-size diamonds, and the United States, Palestine, and South Africa bought cuttables for their cutting shops. Black markets thrived in all the warring nations, diamonds being a favorite investment of citizens of conquered countries and those of belligerent countries whose war future is precarious. Americans bought fine diamonds heavily, partly to supply their craving for beauty, partly as a hedge against inflation.

Since 1939 the price of fine large rough has increased at least 70 percent, and the price is boosted by the Trading Co. on every favorable occasion. As to cut stones, melee under ¼ carat has tripled or quadrupled in value since 1939; ½-carat sizes have gained 80 to 125 percent; 1-carat stones, 67 to 100 percent; and larger stones progressively less. Increases include the excise tax (1943, 10 percent; 1944, 20 percent). Diamonds have never sold higher; and prices may have been advanced too rapidly for the good of the industry.

Stocks of both fine rough for gem purposes and many grades of industrials have been reduced, possibly to a dangerous degree, since demand has markedly exceeded supply. In America the cutters have a more or less satisfactory supply of most grades of rough; but supplies of melee and fine cut in certain sizes are short.

Imports.—As the following table shows, in 1943 the total value of imports of gem diamonds was 163 percent higher than in 1942, the gain being particularly great in rough or uncut diamonds (225 percent); that in cut was also large (115 percent). The quality of both rough and cut paralleled that of 1942, the rise in price during 1943 accounting for the increased prices per carat.

Diamonds imported into the United States, 1942–43, by countries

[Exclusive of industrial diamonds]

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
1942						
Argentina	--------	--------	--------	36	$32,013	$889.25
Belgian Congo	205	$4,573	$22.31	--------	--------	--------
Belgium and Luxemburg	--------	--------	--------	26,755	2,049,057	76.59
Brazil	6,320	477,812	75.60	23,842	2,686,071	112.66
British Guiana	591	19,775	33.46	55	5,810	105.64
British Malaya	--------	--------	--------	278	19,628	70.60
Canada	--------	--------	--------	1	395	395.00
Colombia	--------	--------	--------	18	2,666	148.11
Cuba	--------	--------	--------	2,746	321,863	117.21
France	--------	--------	--------	1,327	184,250	138.85
Germany	--------	--------	--------	162	7,520	46.42
India and Dependencies	--------	--------	--------	1	50	50.00
Mexico	--------	--------	--------	365	41,211	112.91
Netherlands	--------	--------	--------	960	83,341	86.81
Netherlands Indies	--------	--------	--------	117	13,579	116.06
Palestine and Trans-Jordan	--------	--------	--------	20,502	2,994,830	146.08
Switzerland	--------	--------	--------	175	19,346	110.55
Union of South Africa	253,191	10,553,052	41.68	35,351	4,767,308	134.86
United Kingdom of Great Britain and Northern Ireland	1,683	102,154	60.70	13,307	1,410,598	106.00
Venezuela	16,447	389,346	23.67	6	700	116.67
	278,437	11,546,712	41.47	126,004	14,640,236	116.19
1943						
Argentina	--------	--------	--------	67	12,590	187.91
Belgian Congo	1,840	42,294	22.99	--------	--------	--------
Belgium and Luxemburg	1,369	21,444	15.66	19,630	1,329,527	67.73
Brazil	6,207	557,541	89.82	40,933	6,487,150	158.48
British Guiana	2,254	46,243	20.52	185	21,839	118.05
Canada	--------	--------	--------	49	5,255	107.24
Cuba	--------	--------	--------	21,913	3,337,950	152.33
France	--------	--------	--------	567	99,401	175.31
French Guiana	--------	--------	--------	19	2,010	105.79
Gambia and Sierra Leone	3,861	80,432	20.83	--------	--------	--------
Gold Coast	1,000	17,653	17.65	--------	--------	--------
India and Dependencies	--------	--------	--------	63	10,717	170.11

Diamonds imported into the United States, 1942–43, by countries—Continued

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
Mexico				406	$41,273	$101.66
Netherlands				569	121,524	213.57
Palestine and Trans-Jordan				50,361	9,153,273	181.75
Peru				14	1,283	91.64
Portugal	11	$225	$20.45	83	10,888	131.18
Portuguese Guinea and Angola	1,664	40,141	24.12			
Switzerland				112	22,773	203.33
Union of South Africa	702,858	35,338,584	50.28	33,394	6,667,871	199.67
United Kingdom of Great Britain and Northern Ireland	22,833	945,929	41.43	25,336	4,128,516	162.95
Venezuela	7,777	352,754	45.36			
	751,674	37,443,240	49.81	193,701	31,453,840	162.38

Cutting.—Before 1940 the Low Countries cut about 90 percent of the world's diamonds. Since then the industry has been widely scattered over the world. Some 10,000 artisans and apprentices (about one-third of the pre-war force) now supply (except in time of lock-out or strike) an adequate quantity of cut stones. Palestine (3,000 employees), the United States (1,800 employees), and South Africa (550 employees) are now the principal centers of cutting. Brazil, Great Britain, Cuba, Puerto Rico, Canada, India, and Borneo are less important centers.

With the rebirth of the Belgian and Netherlands industries after the war, competition will be keen. Perhaps the United States and South Africa can continue—notwithstanding fantastically high wage scales—to cut large stones profitably, and Palestine may be able to cut small stones.

World production.—Owing to the war accurate diamond-production statistics are not available, but the estimates in the following table are believed to be fairly reliable. World production (gems and industrials) in 1943 is estimated to have been 8,191,360 carats (1.64 metric tons), valued at $27,000,000. The quantity was about 12 percent less and the value 4 percent less than in 1942. The quality was slightly better than in 1942, cuttables making up, by weight, some 22 percent of the total. Belgian Congo was the leading producer, both as to weight and value, although the collective value of the British production exceeded that of the Belgian colony. As DeBeers reopened Dutoitspan on September 1 pipe mines yielded almost 1 percent of the production, but over 99 percent came from placer mines.

The following table shows, as accurately as available statistics permit, world production for the past 5 years.

World production of diamonds, 1939–43, by countries, in metric carats

[Including industrial diamonds]

Country	1939	1940	1941	1942	1943
Africa:					
Angola	690,353	784,270	787,000	[1] 791,850	800,000
Belgian Congo	8,360,000	9,603,000	5,866,000	6,018,000	4,880,000
French Equatorial Africa	[1] 16,000	[1] 16,000	20,000	20,000	20,000
French West Africa	56,314	[1] 75,000	35,000	36,000	36,000
Gold Coast [2]	1,087,652	[1] 825,000	1,000,000	[1] 1,000,000	1,000,000
Sierra Leone	[1] 600,000	750,000	850,000	[1] 850,000	850,000
South-West Africa	35,470	30,017	46,578	56,420	100,000
Tanganyika (exports)	3,445	2,250	[1] 1,750	1,000	500
Union of South Africa:					
Mines	1,089,144	[1] 371,447	----------	----------	[1] 70,000
Alluvial	160,684	[1] 172,027	112,300	117,628	[3] 103,210
Total Union of South Africa	1,249,828	[1] 543,474	112,300	117,628	173,210
Brazil	[1] 350,000	[1] 325,000	325,000	300,000	275,000
British Guiana	32,491	[1] 26,764	27,000	27,000	27,000
Other countries [4]	19,000	31,750	34,350	40,836	29,650
Grand total	12,500,553	13,012,525	9,104,978	9,258,734	8,191,360

Estimated.

1939–40: Exports; 1941–43: Production.

[3] Cape and Transvaal, without Namaqualand, estimated at 53,210 carats.

[4] 1939: Venezuela, India, Borneo, New South Wales, and U. S. S. R.; 1940–41: Borneo, India, New South Wales, U. S. S. R., and Venezuela (Venezuela produced, respectively, 14,525 and 29,399 carats); 1942: Borneo, India, New South Wales, Rhodesia, U. S. S. R., and Venezuela (Venezuela produced 31,570 carats); 1943: Venezuela (23,020 carats), Borneo, India, New South Wales, U. S. S. R., United States (Arkansas), and Bolivia.

Because of a shortage of supplies, the Belgian Congo produced 19 percent less diamond in 1943 than in 1942, and Brazilian and the South African alluvial production decreased; that of South-West Africa increased somewhat.

Dr. N. R. Junner published a most valuable bulletin on the Gold Coast diamond fields. Sierra Leone produced two large gem stones during the year, thus joining the select coterie of large stone producers—India, Borneo, South Africa, and the Bagagem district in Brazil. The occurrence of diamonds in eastern Bolivia is reported.

The Federal Bureau of Mines did some exploratory work on the diamond-bearing kimberlite pipe at Murfreesboro, Ark. It put down 51 bucket drill holes 30 inches in diameter through the softer surface material. They ranged from 10 to over 50 feet in depth, averaging slightly over 30 feet. In all, over 425 tons of samples were taken. These have been washed by South African methods and all diamonds recovered with adequate safeguard to insure reliability of results. The stones recovered are being evaluated by a number of experts and the data assembled and studied. Results are not yet available.

Industrial diamonds.—In 1835 the great British scientist, Sir David Brewster stated that were the diamond not as a gem the "head of the mineral kingdom," "it would have attained the same distinction from its great utility in the arts." World War II has certainly proved the truth of the statement. There is no important war weapon used by our forces that does not employ the diamond in its manufacture.

The use of industrial diamonds, particularly of crushing bort, continues to increase by leaps and bounds under the stimulus of war, although much of the gain will be retained in post-war times. Consumption greatly exceeds production. Finer grades continue scarce, but research and experience prove that the grades available are satisfactory substitutes.

Germany and Japan are already pinched for industrial diamonds, hence their desperate efforts to smuggle this superabrasive into the homelands. Stocks in the United States are adequate, and in case of need the large stock established in Canada by the Diamond Corporation and the principal producers is available.

Before the war the United States consumed about 1,250,000 carats of industrial diamonds a year. The figure had increased to some 10,000,000 carats in 1943. World consumption must be double present production.

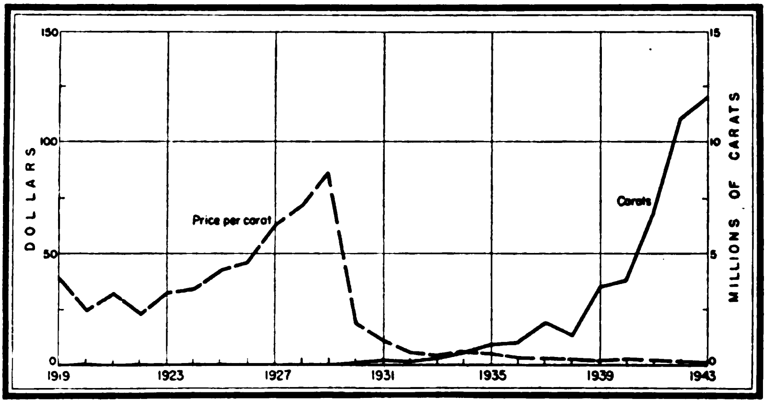

FIGURE 1.—United States imports and average price per carat of industrial diamonds, 1919–43.

Figure 1, prepared by Herbert Backman, illustrates the two outstanding features of the industrial diamond trade in the past quarter century: The tremendous increase in use, particularly since 1938, and the sharp decrease in the average price of the stones used. In 1929 the carbonado market—then the principal source of our imports—was cornered. Now most of our consumption is that of crushing bort.

Imports of industrial diamonds into the United States during the past 5 years were as follows:

Industrial diamonds (glaziers', engravers', and miners') imported for consumption in the United States, 1939–43

Year	Carats	Value		Year	Carats	Value	
		Total	Average			Total	Average
1939	3,568,730	$9,725,683	$2.73	1942	11,203,704	$22,057,577	$1.97
1940	3,809,071	11,026,563	2.89	1943	12,172,679	21,938,368	1.80
1941	6,882,248	14,908,809	2.17				

RUBY, SAPPHIRE, AND EMERALD

The production of fine gem stones—rubies, emeralds, and sapphires—is meager and entirely in the hands of individuals and small partnerships. The ruby mines of Burma and the sapphire mines of Thailand and Indochina may still be operated on a small scale by the natives, but they are shut off from their principal markets, America and western Europe. The Japanese market must be quite restricted.

The Muzo emerald mines have not been operated for several years. The Ceylon sapphire mines and perhaps those of Kashmir are presumably booming, and the American troops stationed in the East constitute an enlarged local market. Before the war the Australian sapphire mines were languishing, and war has also interfered with production at most of the minor gem localities, including the Russian emerald mines and the Montana sapphire mines. Egypt, in its program to develop the mineral resources bordering the Red Sea, has recently announced that the ancient emerald mines are to be reopened; but little, if any, desirable material can be expected from this source.

Paradoxically, there is no dearth of fine gem stones, which, incidentally, have never been more popular. The supply, however, is coming from stocks and from old jewelry, now being bought by almost every jeweler. The restricted production and the phenomenal demand, which are likely to continue after the war, point to higher prices in the future.

Since the war, New York and London have supplanted Paris as the principal colored-stone markets and are now receiving stones direct from the East.

LESSER GEMS

Brazil continues to supply our market with fine and barbarically large aquamarine, topaz and citrine, and other precious stones.

The press reports the Government of Kashmir has authorized exploitation of an opal deposit. If the report is reliable, perhaps Pliny was correct, when 1,900 years ago he emphasized the wealth of India in opal.

From 1890 to the end of 1938, Australia had produced opal worth £1,627,000 in the rough. The 1938 production, largely from South Australia and New South Wales, was worth £8,876, and in 1941 the diggers were said to be busy, so that presumably there is still a small production.

Dr. Henry W. Nichols (see Bibliography) describes a 312-pound block of lapis lazuli exhibited in the Field Museum, Chicago (now Chicago Natural History Museum). It is 2 feet long, 1¼ feet wide, and three-quarters of a foot thick.

In August importers and retailers unabashedly launched Imperial Mexican Jade on the market in a national advertising campaign. The flagrant fake was detected almost immediately, it being proved that the "jade" was merely calcium carbonate ("Mexican onyx") stained green.

Iran and the United States signed a Reciprocal Trade Agreement on April 8, 1943, by which the import duty on cut turquoise into the United States from Iran is reduced from 10 to 5 percent; uncut turquoise has been duty-free for some time. Owing to adequate turquoise deposits, the United States for some years has imported little cut turquoise from Iran.

INSTRUMENT AND CHRONOMETER JEWELS

When the war started, the United States was dependent on Switzerland and France, not only for the synthetic corundum and spinel from which instrument jewels are made but also for their fabrication. Now, the Linde Air Products Co., the Bulova Watch Co., and several smaller companies produce an adequate supply of synthetics, and other firms have adequate fabricating facilities to satisfy the national demand for instrument jewels, which, of course, has been greatly increased by the war. Production increased 370 percent in 1943. War Production Board Order 4717, issued December 23, 1943, eases controls and restrictions on instrument and jewel bearings.

Thus war has introduced in America two more industries—manufacture of synthetics and fabrication of instrument jewels. That of making synthetics presumably should survive after peace is declared.

Small ball bearings have replaced jewels in watches and some instruments, but it is not believed that this substitution will become general.

Out of synthetic sapphire, one American company is now making gages, Diesel injector nozzles, dies for drawing wire from soft metal, and machining tools for soft metals. The gages are of longer life and closer tolerances than those of steel.

Late in the year, the Government of India inquired of Ceylon whether it could furnish 8,000 sapphires and garnets for instrument jewels; further, whether this material could be cut by local lapidaries into instrument jewels. Owing to a shortage of skilled lapidaries, the Colombo jewelers approached were unwilling to attempt to fabricate the jewels.

BIBLIOGRAPHY

BALL, SYDNEY H. The Diamond Industry in 1943. Jewelers' Circular-Keystone, New York, July 1944, 19 pp.

BANNISTER, F. A., AND LONSDALE, K. An X-ray Study of Diamonds Artificially Prepared by J. B. Hannay in 1880. Mineral. Magazine, vol. 26, No. 181, June 1943, pp. 315–324.

BARRETO, B. SANTOS. Quartz from Brazil. Brazil, December 1943, pp. 8–12.

CALMBACK, W. FRIEDRICH VON. Handbuch brasilianischer Edelsteine und ihrer Vorkommen. N. Medowar, Rio de Janeiro, 1938.

GORDON, W. T. The Chemistry of Gemstones. Endeavour, vol. II, July 1943, pp. 99–104.

GUBELIN, EDWARD. The Chemical Compounds of Some Liquid (Gem) Inclusions. Gems and Gemology, 1943, pp. 82–86, 98–100.

JUNNER, N. R. The Diamond Deposits of the Gold Coast, with Notes on Other Diamond Deposits in West Africa. Bannister, F. A. Appendix on crystallography. Gold Coast Geol. Survey Bull. 12, 1943, 52 pp.

KRAUS, EDWARD H. Luxury to Utility (Industrial Use of Precious Stones). Michigan Alumni's Quart. Rev., 1943, pp. 331–336.

MAURO, FRANCESCO. Pietre preciose e simipreziose, delle Alpi Italiane. Natura, Soc. Ital. Sci. Nat., vol. 31 (2) Milan, June 1940, pp. 41–61.

NICHOLS, HENRY W. Large Block of Lapis Lazuli. Field Museum News, March 1943, 1 p.

RHOADS, BERT A. Hunting Jade in Wyoming. Mineralogist, December 1943, pp. 371–373, 382.

WIGGLESWORTH, EDWARD. So-called "Mexican Jade." Gems and Gemology, 1943, p. 87.

NITROGEN COMPOUNDS[1]

By Bertrand L. Johnson

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GENERAL CONDITIONS

Total war still dominated the domestic nitrogen situation in 1943. Nitrogen is essential to the war program, first, in the manufacture of munitions and, second, in the production of food. For the past 2 years supplies of nitrogen have been short, whereas demand is ever-increasing, and to meet current food-production programs the requirements of American farmers for fertilizer nitrogen are at an all-time high.

Before 1943, shortages both for military purposes and for agriculture were evident, but military demands came first. In 1943, emphasis shifted. Decreased ordnance requirements and an increased ordnance supply of anhydrous ammonia made available, for agriculture, increasingly large supplies of ammonia and ammonium nitrate from the munitions plants. The Government encouraged use of this excess supply of ammonium nitrate for fertilizer purposes because of the shortage of nitrogen and the possibility that the shipping normally required for the importation of nitrate of soda from Chile might be conserved. The substitution of ammonium nitrate for sodium nitrate in mixed fertilizers leaves the reduced imports of the Chilean material available for direct application to the soil only.

INORGANIC NITROGEN COMPOUNDS

NATURAL NITRATES

Domestic nitrate deposits.—Although deposits of soluble nitrate minerals are widely distributed in the United States they are too small and too low-grade to serve as a basis for a domestic nitrate industry. Many of the known deposits have been studied, and references to the various published reports are given in the Nitrogen Compounds chapter of Minerals Yearbook, 1942 (p. 1522). There has been no recent output from any of these deposits of natural nitrates, so far as known.

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[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

Chilean nitrate.—Large quantities of natural sodium nitrate and smaller amounts of potassium-sodium nitrate are imported from Chile annually, at present under a wartime subsidy whereby the United States Government absorbs some of the increased costs and prices. These imported sodium nitrates are under allocation, and it is reported that in the year ended June 30, 1943, about 8 percent of the total was applied to war industries and 92 percent to agriculture.

In the fertilizer year July 1, 1942, to June 30, 1943, about 812,000 tons of Chilean nitrate are said to have been used for side and top dressing for crops and a much smaller quantity in mixed fertilizers. In the year begun July 1, 1943, imports of only about 500,000 tons of Chilean nitrate are forecast—a quantity that will be inadequate for full agricultural requirements. Therefore, contrary to the practice in previous years, no nitrate of soda will be allowed in mixed fertilizers during the fertilizer year 1943–44. Its use is restricted to direct application as side and top dressings. Supplies of Chilean nitrate supplemented by synthetic nitrate of soda, equal to about 90 percent of the tonnages used in the previous year, are believed available for this purpose.

Sodium nitrate imported for consumption in the United States, 1939–43

Year	Chile		Total		Year	Chile		Total	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1939	676,409	$11,199,895	676,917	$11,213,445	1942	899,090	$17,180,780	899,150	$17,183,425
1940	744,145	12,451,179	744,145	12,451,179	1943	745,631	14,808,489	745,631	14,808,489
1941	610,561	10,868,222	610,569	10,868,568					

Potassium-sodium nitrate (all from Chile) imported for consumption in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	55,164	$1,235,078	1942	14,272	$377,703
1940	55,016	1,366,131	1943	19,767	580,760
1941	34,541	725,846			

SYNTHETIC NITROGEN COMPOUNDS

General.—The general situation with regard to the synthetic nitrogen industry in the United States in 1942 was covered in the Nitrogen Compounds chapter of Minerals Yearbook, 1942 (pp. 1521–1524). The following summary presents the major developments with respect to diverse synthetic nitrogen compounds in the succeeding calendar year, 1943.

Ammonia and its compounds.—The principal uses of ammonia have been military and agricultural; minor quantities are utilized in industry. A surplus of ammonia above military needs became evident in 1943, and restrictions on the use of anhydrous and aqua ammonia in agriculture and industry were relaxed. Ammoniation of superphosphate again became possible.

The domestic capacity for the production of synthetic ammonia has been greatly increased over the pre-war status and now is apparently much greater than any probable post-war demand. Exact figures for the current productive capacity are not yet available. Various estimates have been made, ranging from a general one of twice the maximum pre-war consumption to a recent, more definite statement[2] of 1,322,000 tons.

Synthetic ammonia production from numerous private and Government-owned plants is said to have reached a new high record in 1943. Figures, however, are not available.

Sales of byproduct-coke ammonia liquor (NH_3 content), according to the Bureau of Mines, were 35,674 short tons in 1943 compared with 31,938 tons in 1942. Production likewise was higher but not high enough to compensate for the sharply increased sales, and stocks declined. Considerable quantities of synthetic ammoniating solutions were produced in 1943, some of which were allocated to the fertilizer industry.

General Preference Order M–163, effective June 1, 1942, placed byproduct ammonia under complete allocation control by the War Production Board. General Preference Order M–164, effective the same date, provided for allocation control of synthetic ammonia by the same authority. Both orders remained in force throughout 1943.

Ammonium sulfate, one of the most important agricultural fertilizers and one of the principal sources of nitrogen in mixed fertilizers, is obtained solely as a manufactured product. Virtually all produced is employed for fertilizer purposes. The production of byproduct-coke ammonium sulfate, which constitutes almost the entire production in the United States, decreased from 766,804 short tons in 1942 to 762,645 tons in 1943, but sales increased from 751,914 to 774,834 tons, with a resultant marked decrease in stocks on hand at the end of 1943. Some additional quantities of ammonium sulfate came from other sources. The price of ammonium sulfate per 100 pounds remained at $1.46 f. o. b. Atlantic ports throughout 1943.

War Production Board General Preference Order M–163 of May 30, 1942, effective June 1, 1942, which placed byproduct ammonium sulfate under allocation, remained effective throughout 1943.

Ammonium nitrate was originally produced in large quantities for munitions, but because of decreased ordnance requirements and a larger output substantial supplies were freed by both private and Government-owned plants for fertilizer purposes.

Ammonium nitrate is not a new fertilizer or fertilizer ingredient, but farmers are not generally familiar with it. Consumption of ammonium nitrate, in combination with other materials, in various fertilizers during the years shortly before World War II ranged from a minimum of 1,000 tons in 1932 to 68,000 tons in 1937. Approximately 65,000 tons of ammonium nitrate were used in 1941. The total available supply of ammonium nitrate for fertilizer use in the fertilizer year 1943–44 has been estimated at 345,900 tons. After December 1, 1943, all commercial ammonium nitrate mixtures produced in the United States were to be guaranteed to contain 32.5 percent nitrogen. The pure material contains about 35 percent nitrogen, one-half of which is in the ammoniacal and one-half in the nitrate form.

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[2] Fortune, Nitrogen: Competition or Not: Vol. 29, No. 2, February 1944, pp. 129–130, 232, 234, 236, 238, 241–242, 244, 247.

Early in 1943 imports of a mixture of ammonium nitrate and limestone produced in Ontario, Canada, were released by the War Production Board for direct application to the soil. Later in the spring ammonium nitrate from certain domestic war plants became available for fertilizer use, and shipments were made from the Tennessee Valley Authority plant at Muscle Shoals, Ala., and a privately owned plant in California. At the end of 1943 ammonium nitrate for fertilizer use was being produced by a number of Government plants in the United States and Canada and by one private plant in California. The Canadian material was handled through private brokers and the Tennessee Valley Authority material by that organization. Effective November 1, 1943, distribution of the ammonium nitrate from the Army's ordnance plants was placed in the hands of the Tennessee Valley Authority for the ensuing 3 months.

The quoted price on the Canadian ammonium nitrate mixture early in 1943 was $56.65 per short ton f. o. b. Port Robinson, Ontario, but in May 1943 was reduced to $47.65. The T. V. A. price of United States ammonium nitrate, November 1, 1943, to January 31, 1944, was set at $49 a ton f. o. b. point of production.

Numerous articles have recently appeared on ammonium nitrate and its use as a fertilizer mixture.[3]

Sodium nitrate.—Little information is available regarding the current production or utilization of domestically produced synthetic sodium nitrate. According to the Department of Agriculture, domestic production and imports to be allocated for direct application are expected to total 805,000 short tons in the year ending June 30, 1944. According to report about 300,000 tons of this available supply is domestic synthetic sodium nitrate.

General Preference Order M–62, effective January 15, 1942, controls the supply and distribution of the synthetic sodium nitrate as well as the imported natural nitrate from Chile.

ORGANIC MATERIALS

An increased demand for organic nitrogen-bearing fertilizers arose late in 1942 because of restrictions in the use of chemical nitrogen. To secure equitable distribution, on May 7, 1943, the War Food Administration issued Food Production Order 12, effective May 1, 1943, banning purchase of these materials by fertilizer manufacturers without prior approval of the director of food production. On June 7, 1943, a revised Food Production Order 12, effective June 1, 1943, to July 1, 1944, was issued. This order limited the quantity that could be so used to 70 percent of that used in 1941–42. About 25,000 tons of organic nitrogen were expected to be available during the period covered by the order, compared with 35,000 tons used in mixed fertilizer in the 1941–42 period.

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[3] Smith, A. M., Ammonium Nitrate in Mixed Fertilizers: Chem. and Eng. News, vol. 21, No. 24, December 25, 1943, pp. 2100–2102.

Whittaker, C. W., and Mehring, A. L., Nitrogenous Fertilizers for Direct Application: Fertilizer Rev., vol. 18, No. 4, October–November–December 1943, pp. 2–3, 13.

Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Soil and Fertilizer Investigations, The Preparation of Ammonium Nitrate for Use as a Fertilizer: U. S. Dept. of Agriculture, September 8, 1943, 13 pp.; Am. Fertilizer, vol. 99, No. 7, 1943, pp. 5–8, 22, 24, 26; Commercial Fertilizer, vol. 67, No. 5, 1943, pp. 16, 18, 20, 22, 24, 26.

Bureau of Plant Industry, Soils, and Agricultural Engineering, Division of Soil and Fertilizer Investigations, The Use of Ammonium Nitrate in Mixed Fertilizers: U. S. Dept. of Agriculture, September, 1943, 13 pp.; Am. Fertilizer, vol. 99, No. 8, 1943, pp. 5–7, 20, 22, 24; No. 9, 1943, pp. 10–11; Commercial Fertilizer, vol. 67, No. 6, 1943, pp. 32–38.

Miller, A. M., and Junkins, J. N., Nitrogen Fixation at the T. V. A. Ammonia Plant: Chem. and Met. Eng., vol. 50, No. 11, November 1943, pp. 119–125.

Ross, W. H., and Yee, J. Y., The Preparation of Ammonium Nitrate for Use as a Top Dressing: Paper read at meeting of the American Chemical Society, Division of Fertilizer Chemistry, Pittsburgh, Pa., September 6–10, 1943; abs., Am. Fertilizer, vol. 99, No. 7, September 25, 1943, pp. 9–10.

Hardesty, J. O., Yee, J. Y., and Gaddy, V. L., Ammonium Nitrate as a Component of Mixed Fertilizers: Paper read at meeting of the American Chemical Society, Division of Fertilizer Chemistry, Pittsburgh, Pa., September 6–10, 1943; abs., Am. Fertilizer, vol. 99, No. 7, September 25, 1943, p. 10.

Parker, F. W., and Ross, W. H., Problems in Formulating Fertilizers for 1943–44: Nat. Fertilizer Assoc., Proc. 19th Annual Convention, 1943, pp. 52–60; discussion, pp. 61–63.

Calcium cyanamide is not produced in the United States but has been made since about 1910 at the plant of the American Cyanamid Co. of New York at Niagara Falls, Canada, and marketed under the trade name Cyanamid. In 1941, 83,337 tons of cyanamide were imported into the United States for consumption under allocation, principally in Mississippi, Louisiana, and Arkansas.

Urea, a synthetic organic nitrogenous compound containing 46.65 percent nitrogen when pure, now used in considerable quantities in the United States as a fertilizer material, has been produced commercially in the United States only within the last 10 years. The consumption of urea in fertilizer mixtures in the United States increased from 75 short tons in 1925 to over 34,000 tons in 1940. A detailed discussion of this material is given in a recent publication.[4]

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[4] Merz, A. R., and Brown, B. E., Production and Fertilizer Use of Urea: U. S. Dept. Agriculture Circular 679, October 1943, 18 pp.

MINOR NONMETALS

By G. Richards Gwinn [1]

SUMMARY OUTLINE

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GRAPHITE

Production and sales of domestic natural and artificial graphite increased in 1943. The combined total of crystalline and amorphous graphite produced by domestic mines in 1943 was 9,939 short tons, and shipments reached 9,597 tons valued at $903,102, compared with a production of 7,120 short tons and sales of 7,253 tons valued at $401,690 in 1942. Artificial or, more properly, manufactured graphite [2] was produced by the Acheson Graphite Division of the National Carbon Co., Inc., 30 East Forty-second Street, New York, N. Y., from a plant operated at Niagara Falls, N. Y. The uncertainty of foreign shipments prompted the production and stock-piling of domestic natural graphite for use as insurance against the possibility of complete stoppage of imports from Madagascar and Ceylon. However, by the end of 1943, the stocks of strategic graphite in the United States had improved to the extent that domestic plants built with the aid of Reconstruction Finance Corporation funds were shut down. This improvement is reflected in the supplements and amendments to War Production Board Order M–61 relative to the conservation and use of strategic graphite. At the beginning of 1943, all graphite in flake, lump, or chip form of plus 50-mesh U. S. Sieve Series was considered as strategic, and in July the production of graphite crucibles was restricted to those designated as standard by the industry. However, by January 1, 1944, only Madagascar flake graphite of plus 50-mesh screen size was considered as strategic, restrictions on the acquisition of graphite crucibles were relaxed to the point that only inventory control was exercised, and Ceylon lump and chip and domestic flake graphite were removed from the strategic list by the War Production Board.

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[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the United States Department of Commerce.

[2] Gwinn, G. Richards, Graphite—Natural and Manufactured: Bureau of Mines Inf. Circ. 7266, 1943, 26 pp.

Graphite (natural and artificial) imported for consumption in the United States, 1939–43

Year	Crystalline				Amorphous				Total (natural and artificial)	
	Flake		Lump, chip, or dust		Natural		Artificial			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1939	2,260	$110,476	602	$30,421	18,675	$269,046	413	$15,383	21,950	$425,326
1940	6,551	340,396	752	54,027	23,766	487,675	260	9,187	31,329	891,285
1941	4,877	289,322	2,900	370,413	33,382	1,363,434	38	1,384	41,197	2,024,553
1942:										
Canada	7	2,376			629	36,133	169	4,739	805	43,248
Ceylon	280	19,098	3,922	582,928	9,007	1,169,469			13,209	1,771,495
China			68	9,680					68	9,680
India and Dependencies			56	3,820					56	3,820
Madagascar	5,744	391,445	106	4,722					5,850	396,167
Mexico					23,933	274,476			23,933	274,476
Union of South Africa					(1)	1			(1)	1
	6,031	412,919	4,152	601,150	33,569	1,480,079	169	4,739	43,921	2,498.887
1943:										
Canada	40	12,909	30	6,719	532	47,084	205	15,515	807	82,227
Ceylon	168	32,850	168	29,828	144	10,566			480	73,244
India and Dependencies			260	51,068					260	51,068
Madagascar	5,101	447,306	554	30,180					5,655	477,486
Mexico					21,679	270.877			21,679	270,877
Mozambique	2	317							2	317
	5,311	493,382	1,012	117,795	22,355	328,527	205	15,515	28,883	955,219

[1] Less than 1 ton.

Stocks of Madagascar flake and Ceylon lump and chip on January 1, 1943, were, respectively, 3,583 and 2,191 short tons, as reported by the Graphite Branch of the War Production Board. Imports of 5,101 short tons of Madagascar flake plus stocks made a total supply of 8,684 short tons. Consumption of this flake averaged about 400 tons per month, leaving stocks of about 4,200 tons, or about 11 months' supply at the present requirement rate. Imports of Ceylon graphite of all grades decreased markedly in 1943 because of a reduction in requirements and increase in stocks. Imports of 168 short tons of crucible-grade graphite from Ceylon plus stocks made a total supply of 2,358 tons. Consumption of this material averaged about 66 tons per month for the first three quarters and 55 tons for the last quarter of the year, or a total of 759 short tons, leaving stocks at the close of the year of about 1,599 short tons, or about 29 months' supply. Because of a decrease in requirements by gray-iron foundries and increasing stock piles, imports of Mexican amorphous were also lower in 1943 than in the previous year. Stocks of graphite fines represent a 2 years' supply.

Exports of natural graphite, 1939–43, were—1939: 976 short tons, valued at $109,715; 1940: 1,632 tons, $148,639; 1941: 1,723 tons, $166,612; 1942: 4,095 tons, $413,281; and 1943: 3,010 tons, $317,586. The export market includes Canada, England, U. S. S. R., Mexico, India, and Central and South American countries.

Wartime demands have brought mines into production from several new sources, notably South Australia (Port Lincoln), Tasmania, Portuguese East Africa, and India. The industrial research division in India carried out pilot-plant work on obtaining flake graphite by flotation and colloidal graphite from natural-graphite fines.

Metals Reserve Co. prices for domestic flake graphite in 1943 were as follows, in cents per pound: No. 1A, 14; No. 1, 13; No. 1B, 12; No. 2, 11; No. 3, 7; No. 4, 5. Prices for Madagascar and Ceylon graphite in carlots, f. o. b. New York City, duty paid, in 1943 were, in cents per pound: Madagascar No. 1 Flake, 9 to 16; No. 2 Flake, 7 upward; Fines (ground), 55 to 70 percent carbon, 3 upward; Ceylon Lump, 10 to 12; Carbon Lump, 9 to 10; Chip, 7; and Dust, 4 to 5.

Although the quantity of domestic graphite is adequate, the quality is not satisfactory for crucible use, and production costs are greater than for crucible-grade Madagascar and Ceylon material. Therefore, with availability of imported material assured, there is little prospect of post-war market demands for domestic graphite exceeding those of pre-war years.

Figures for total world production are not available. A table covering the period 1915–39 appeared in Minerals Yearbook, Review of 1940 (p. 1414), and the following table includes all production figures from 1937 through 1943 that can be obtained.

World production of natural graphite, 1937–43, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943
Argentina	25	28		100	135	248	(2)
Australia:							
New South Wales					64	[3] 61	(2)
Queensland	12	10		63	320	[3] 224	(2)
South Australia	2				50	[3] 186	(2)
Tasmania				5	5	[3] 5	(2)
Brazil (exports)	9		(2)	(2)	60	72	1:
Bulgaria			23	50	(2)	(2)	(2)
Canada (exports)	2,675	1,044	1,199	1,381	905	463	(2)
Ceylon (exports)	17,660	11,972	22,756	24,414	(2)	27,872	20,830
Chosen (exports)	43,569	50,348	78,501	[4] 12,591	(2)	(2)	(2)
Czechoslovakia	5,144	(2)	(2)	(2)	(2)	(2)	(2)
Germany:							
Austria	18,158	16,852	(2)	(2)	(2)	(2)	(2)
Bavaria	23,544	28,106	(2)	(2)	(2)	(2)	(2)
Greenland	60	(2)	(2)	(2)	(2)	(2)	(2)
India, British	567	465	951	(2)	(2)	(2)	(2)
Indochina (exports)		1	2	(2)	(2)	(2)	(2)
Italy	5,411	5,485	(2)	(2)	(2)	(2)	(2)
Madagascar	[5] 12,387	[5] 13,433	[5] 12,270	15,311	13,018	[3] 12,000	[3] 18,000
Mexico	11,210	9,611	9,815	12,327	16,928	20,811	20,677
Morocco:							
French (exports)	152	369	[6] 283	(2)	(2)	(2)	(2)
Spanish		73	(2)	[5] 353	[5] 408	(2)	(2)
Norway	3,638	3,802	4,333	(2)	(2)	(2)	(2)
South-West Africa				71	188	(2)	[7] 1,359
Spain			54	353	23	(2)	(2)
Sweden	25	48	165	(2)	(2)	(2)	(2)
Union of South Africa	63	54	59	78	[8] 62	[7] 233	[7] 621
United States:							
Amorphous	(9)	(9)	(9)	(9)	(9)	6,459	9,016
Crystalline	(9)	(9)	(9)		(9)		

[1] In addition to countries listed graphite is produced in France, Japan, Nyasaland, Portuguese East Africa, and U. S. S. R., but production data are not available.

[2] Data not available.

[3] Estimate.

[4] April to December, inclusive.

[5] Exports.

[6] January to June, inclusive.

[7] January to September, inclusive.

[8] January to October, inclusive.

[9] Bureau of Mines not at liberty to publish figures.

KYANITE, ANDALUSITE, AND DUMORTIERITE

Domestic production and imports of the kyanite-group minerals continued to increase during 1943. Supplies and stocks of imported kyanite were more than adequate for current requirements; therefore, War Production Board Conservation Order M–143 on Indian kyanite, effective May 6, 1942, was withdrawn on November 22, 1943, and inventory control only will be retained to insure a safe supply.

Imports of 514 short tons of sillimanite, a trimorph of kyanite, were received from New South Wales, Australia, in 1943. The material received did not prove satisfactory for heavy-duty refractories, but it seems probable that selective mining of the deposit would produce an acceptable product.

Indian kyanite, in grain sizes from one-fourth inch to 35 mesh, furnishes a coarse-grained product that, when fabricated into a shaped form, meets the requirements of the ceramic and metallurgical industries for heavy-duty refractories. The total supply of Indian kyanite in 1943 was 19,457 short tons. Domestic consumption amounted to 8,416 tons, and 158 tons were reexported to Canada, leaving stocks of 10,883 short tons, of which 5,643 tons were in the hands of the industry and 5,240 tons in the Government stock pile.

Domestic shipments, imports, and stocks of kyanite in the United States, 1940–43

Year	Domestic shipments		Imports from British India		Total new supply		Stocks of Indian kyanite[1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1940	4,241	$93,716	7,658	$92,159	11,899	$185,875	(2)	(2)
1941	8,335	175,581	14,285	175,218	22,620	350,799	(2)	(2)
1942	8,708	190,750	6,524	93,743	15,232	284,493	[3] 9,485	$449,317
1943	9,561	238,649	9,972	105,042	19,533	343,691	10,883	515,527

[1] Industry and Government stocks as of Dec. 31, as reported by Miscellaneous Minerals Division, War Production Board.
[2] Figures not available.
[3] As corrected by War Production Board.

Domestic production of refractory-grade kyanite was adequate for current requirements, but a shortage of low-iron, glass-grade kyanite developed because of milling difficulties at the plant of the Yancey Cyanite Co. at Burnsville, N. C., the sole domestic producer. This plant ceased operation on January 5, 1944. The Kyanite Products Corporation, near Farmville, Va., with increased plant production and stabilized manpower, was able to fill all orders for refractory-grade kyanite without reaching maximum production.

The cost of Indian kyanite delivered at Atlantic seaports in 1943 was $54 per short ton. Prices for domestic kyanite, controlled by the Office of Price Administration under Order MPR–327, effective February 17, 1943, were revised upward later in the year. Prices set for the Kyanite Products Corporation of 61 Broadway, New York, N. Y.—$19 per short ton for raw kyanite, 35-mesh, in carlots to $37.50 for 325-mesh material, less than carlots, in 100-pound bags, and $26.50 per short ton for calcined kyanite, 35-mesh, in carlots, to $42.50 for 325-mesh material, less than carlots, f. o. b. Cullen or Pamplin, Va.—were raised $5 per ton for all classes in amendment 4 of this order, effective November 2, 1943. The ceiling price for glass-grade kyanite produced by the Yancey Cyanite Co. (Asheville, N. C.), fixed at $40 per ton on February 17, 1943, was raised to $45 per ton and later was lifted entirely.

Production of andalusite at White Mountain, Mono County, Calif., by Champion Sillimanite, Inc., Merced, Calif., decreased slightly from the 1942 level; but production of dumortierite at Oreana, Pershing County, Nev., by the same company—the only domestic producer of either mineral in 1943—increased. This material was shipped to the parent firm, Champion Spark Plug Co., Detroit, Mich., for use in spark-plug cores and other electrical porcelains.

LITHIUM MINERALS

Although production of lithium minerals and compounds in 1943 was greater than in any preceding year since 1920, it was not sufficient to keep pace with demands. Shipments of spodumene were greater than the total sales of lithium minerals in 1942, but the production of lepidolite, amblygonite, and dilithium sodium phosphate decreased.

The shortage of spodumene concentrates that developed in 1942 because of inadequate milling facilities continued through 1943. Although the Solvay Process Co. plant at Kings Mountain, N. C., began operations on May 17, unexpected difficulties in milling practices arose, and problems of priorities for steel and machinery slowed the rebuilding of the Black Hills Tin Co. plant at Tinton, S. Dak. However, there has not been a shortage of ore. The requirements for lepidolite for use in the manufacture of boron silicate glass for electronic tubes and high-pressure boiler gages also exceeded domestic production, and it became necessary to import spodumene and lepidolite. Imports amounted to 832 short tons—276 tons of spodumene from Brazil, 166 tons of spodumene from Argentina, and 390 tons of lepidolite from Southwest Africa.[3]

Shipments of lithium compounds from mines in the United States, 1939–43

Year	Short tons	Value
1939	1,990	$97,000
1940	2,011	80,679
1941	3,832	115,718
1942	5,405	$243,516
1943	8,155	314,660

However, by December 1943 the Kings Mountain plant was operating at near maximum level, and the Black Hills plant began production on February 1, 1944. The decrease in production of lepidolite, amblygonite, and dilithium sodium phosphate may be attributed in part to the emphasis placed by the War Production Board upon the production of spodumene. As it will take some time to increase domestic production to meet requirements, additional imports of lepidolite will be required in 1944.

Prices for lithium ores produced in the United States for sale on the open market, as quoted by E&MJ Metal and Mineral Markets, in 1943 were as follows: Spodumene $5 per 20 pounds of contained lithia (Li_2O), 6 percent minimum, $30 per short ton, in carlots; amblygonite, 8 to 9 percent (Li_2O), $40 to $50 per short ton, f. o. b. mine; and lepidolite, 3 percent (Li_2O), $24 to $25 per short ton, f. o. b. mine.

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[3] Reported by the War Production Board, Statistics Division, Materials Branch; checked by War Shipping Administration.

Although the increased demand for lithium minerals and compounds may be attributed to their use as bases of many essential war products, the majority of these products will have a post-war use, and it is reasonable to believe that post-war requirements for these minerals will be larger than in 1939, a peak pre-war year.

MINERAL EARTH PIGMENTS AND MANUFACTURED IRON OXIDE PIGMENTS

[Prepared by Charles L. Harness]

Sales of natural and synthetic iron oxide-containing pigments increased 3 percent in quantity in 1943 over 1942. The increase, in view of negligible civilian construction activity, pointed to expanded military uses. Iron oxide pigments find extensive application in flat camouflage paints for trucks, "jeeps," artillery, and aircraft. Much yellow iron oxide is compounded with chromic oxide to form the well-known olive-drab shade. Paint for the shipbuilding program required large quantities of both natural and synthetic red iron oxide in 1943.

Statistics of production and foreign trade are presented in the following tables:

Natural mineral pigments and manufactured iron oxide pigments sold by processors in the United States, 1942–43, by kinds

Pigment	1942		1943	
	Short tons	Value	Short tons	Value
Mineral blacks	2,229	$83,558	3,428	$104,369
Precipitated magnetic blacks	2,244	378,395	1,602	271,516
Natural brown oxides (metallic browns)	7,839	334,445	7,114	337,514
Vandyke brown (finished pigment) and sap brown	208	27,915	899	154,845
Pure browns (96 percent or better iron oxides)	1,085	191,248	818	163,122
Natural red oxides	17,452	863,424	23,703	874,363
Pure red oxides (98 percent or better Fe_2O_3)	9,160	1,551,209	10,239	1,791,964
Venetian reds	8,507	557,576	6,873	513,421
Pyrite cinder	(1)	(1)	883	53,670
Other red iron oxides	5,996	518,084	4,621	421,423
Natural yellow oxides (high Fe_2O_3)	8,223	228,197	5,017	179,099
Pure yellows (85 percent or better Fe_2O_3)	14,426	1,963,519	14,833	2,060,636
Ochers (low Fe_2O_3)	12,537	398,820	9,246	344,198
Siennas:				
Burnt	887	101,608	818	110,313
Not burnt	2,358	309,699	1,891	210,132
Umbers:				
Burnt	2,335	140,934	1,759	85,437
Not burnt	1,146	71,189	4,290	132,744
Other	695	44,412	2,632	220,291
	97,327	7,764,232	100,666	8,029,057

[1] Included under "Other."

Natural mineral pigments and manufactured iron oxide pigments sold by processors in the United States, 1942–43, by States where processed

State where processed	1942		1943	
	Short tons	Value	Short tons	Value
California	(1)	(1)	3,918	$432,181
Georgia	7,067	$133,111	5,010	105,910
Maryland	2,220	147,600	(1)	(1)
Pennsylvania	31,815	3,142,177	40,906	3,106,154
Other States [2]	56,225	4,341,344	50,832	4,384,812
	97,327	7,764,232	100,666	8,029,057

[1] Included under "Other States."

[2] 1942: Arkansas, California, Illinois, New Jersey, New York, North Dakota, Ohio, Tennessee, Virginia, and Wisconsin; 1943: Arkansas, Illinois, Maryland, Michigan, New Jersey, New York, North Dakota, Ohio, Tennessee, Virginia, and Wisconsin.

Dry ocher, sienna, umber, and other forms of iron oxide for paint exported from the United States, 1940–43, by countries

Country	1940		1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	462	$57,348	325	$44,906	50	$9,043	34	$7,510
Bolivia	(1)	9	3	1,301	5	1,022	35	6,909
Brazil	142	23,397	243	35,319	108	22,188	66	15,105
Canada	2,691	133,693	3,006	200,427	2,364	151,109	2,660	198,296
Chile	53	10,956	91	14,486	59	10,868	80	18,776
Colombia	22	4,275	124	24,751	97	26,857	169	39,401
Cuba	45	6,340	172	21,872	359	33,681	314	44,751
Curaçao (N. W. I.)	1	93	7	915	12	1,517	58	29,077
France	24	3,258						
Mexico	122	24,319	210	39,411	153	32,902	283	59,428
Netherlands Indies	82	10,182	137	25,099	27	4,830		
United Kingdom [2]	1,166	33,427	20	8,696	1	224	1	144
Venezuela	89	11,563	161	19,264	100	16,112	94	18,649
Other countries	298	28,250	441	55,359	296	52,304	576	66,674
	5,197	347,110	4,940	491,806	3,631	362,657	4,370	504,810

[1] Less than 1 ton.
[2] United Kingdom of Great Britain and Northern Ireland.

Selected mineral pigments imported for consumption in the United States, 1940–43, by kinds

Pigment	1940		1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Iron oxide pigments:								
Natural	7,451	$248,290	6,196	$232,924	1,936	$60,405	581	$22,051
Synthetic	2,213	246,898	2,321	290,162	1,978	250,779	800	92,966
Ocher, crude and refined	2,099	52,257	380	11,717	477	12,036	78	1,810
Sienna, crude and refined	815	39,740						
Umber, crude and refined	2,826	43,580	31	1,579	5	159		
Vandyke brown	7	722	3	185	(1)	43		
	15,411	631,487	8,931	536,567	4,396	323,422	1,459	116,827

[1] Less than 1 ton.

The war has cut off or curtailed imports of many foreign earth pigments, including Turkey umbers, Italian siennas, French ochers, and Persian and Spanish red oxides, and for most products the domestic pigment industry has supplied replacements that are as good as or better than the foreign pigments, costs and quality considered. Possible exceptions are Persian and Spanish red oxides, for which no substitute seems to have proved completely satisfactory. There is every indication that the domestic pigment industry will supply most post-war domestic earth-pigment markets formerly dominated by foreign products.

Prices of finished earth pigments, which are quoted in cents per pound, were generally unchanged during the year, according to the Oil, Paint and Drug Reporter. Precipitated magnetic blacks, in barrels, less carlots, works, were quoted at 8½; metallic browns were 2½ in barrels; Vandyke brown sold at 9 and sap-brown crystals at 12; synthetic browns, 12; synthetic red iron oxides, 9¾; Venetian reds, 2.2 to 4, depending on the iron oxide content; natural yellow oxides, high-iron, 5; synthetic iron oxide yellows, 7.1; domestic French-type ochers, 3.45; burnt siennas were quoted over a range of 3¾ to 10¾;

Italian type siennas over a range of 3¼ to 16¾, prices increasing later in the year; raw siennas ranged from 4 to 10; and umbers were quoted at 3⅜ to 5⅞, depending on quality and point of purchase.

MINERAL WOOL

Mineral-wool production in 1943 reached 551,524 short tons valued at $43,670,710, an increase of $10,863,902 in value and approximately 33,000 tons in quantity over the 1942 total. Sales of home insulation increased and those of industrial insulation decreased from 1942 totals. Production in 1943 came from 40 companies operating 53 plants in 19 States, compared with 41 companies operating 52 plants in 18 States in 1942, the first year for which statistics on mineral wool were collected by the Bureau of Mines.

Production of mineral wool in the United States, 1942–43

Product	Home insulation		Industrial insulation		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1942						
Loose wool (sold as such)	58,586	$1,442,900	5,244	$175,007	63,830	$1,617,907
Granulated wool (sold as such)	183,107	6,286,421	6,279	241,389	189,386	6,527,810
Bats	86,716	4,960,812	60,346	4,624,546	147,062	9,585,358
Rolls	49,194	2,144,927	1,518	66,305	50,712	2,211,232
Felt	41	3,590	24,687	1,838,476	24,728	1,842,066
Blocks			3,091	1,204,331	3,091	1,204,331
Boards			8,498	6,339,818	8,498	6,339,818
Mineral wool insulating cement	929	37,663	11,728	820,674	12,657	858,337
Blankets			4,632	904,377	4,632	904,377
Other	569	40,113	7,907	525,578	8,476	565,691
Total	379,142	14,916,426	133,930	16,740,501	513,072	31,656,927
Pipe covering			[1] 5,624,106	1,149,881	[1] 5,624,106	1,149,881
Grand total	379,142	14,916,426		17,890,382		32,806,808
1943						
Loose wool (sold as such)	62,978	1,720,375	6,600	191,584	69,578	1,911,959
Granulated wool (sold as such)	277,833	10,257,797	6,704	219,975	284,537	10,477,772
Bats	56,737	4,386,006	3,416	659,799	60,153	5,045,805
Rolls	10,117	541,256	65	2,819	10,182	544,075
Felt	6,781	791,781	34,764	5,236,679	41,545	6,028,460
Blocks	453	40,960	11,068	1,900,450	11,521	1,941,410
Boards			26,003	12,495,640	26,003	12,495,640
Mineral wool insulating cement	3,432	238,006	18,839	1,230,681	22,271	1,468,687
Blankets	402	68,862	9,111	1,246,908	9,513	1,315,770
Pipe covering	11	1,522	6,875	1,443,969	6,886	1,445,491
Other	4,029	91,024	5,306	904,617	9,335	995,641
Grand total	422,773	18,137,589	128,751	25,533,121	551,524	43,670,710

[1] Linear feet; approximately 5,500 short tons.

It seems probable that the increase in home insulation may be attributed largely to the Government-sponsored program for insulating homes to conserve fuel, and the decrease in industrial insulation to the wartime conservation of materials for construction or expansion of industrial plants. As part of the fuel-saving program, the Bureau of Mines issued an information circular on the conservation of fuel in industrial plants by means of insulation,[4] and the Industrial Mineral Wool Institute, 441 Lexington Ave., New York, N. Y., prepared a heat- and power-conservation manual. In September, the National Bureau of Standards and the Industrial Mineral Wool Institute proposed commercial specifications for the use of mineral-wool blankets, blocks, pipe covering, and insulating cement for heated surfaces. They have been accepted as Commercial Standard CS 117–44 for high-temperature installations effective from May 25, 1944.

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[4] Bowles, Oliver, Industrial Insulation with Mineral Products: Bureau of Mines Inf. Circ. 7263, 1943, 17 pp.

The Office of Price Administration, on September 16, 1943, under amendment 3 of Order A–2 of Maximum Price Regulation 188, provided for an adjustment in maximum prices of producers of mineral wool. The new provision permits the granting of relief to cover total manufacturing costs for manufacturers who are unable to maintain or expand production under existing maximum prices in areas where there is a general shortage and where operation of all plants in the area is necessary to prevent an increase in the price to the consumer. Prices in 1943, per short ton, in carlots f. o. b. plant, were $30 for loose and $45 for granulated wool.

Although conservation of fuel during wartime has been instrumental in increasing the production and sales of mineral wool, insulation is a permanent economy and an effective means at all times of overcoming the discomforts of both heat and cold. It seems probable, therefore, that the post-war market for mineral-wool products will be larger than during the years immediately preceding the war.

MONAZITE

Imports of monazite sands in 1943 from Brazil and India, currently our only source, increased 12 percent in quantity and 24 percent in value compared with 1942. Domestic consumption decreased, and stocks increased during 1943. At the request of the Army and Navy, the Procurement Division of the Treasury Department in 1943 purchased abroad 3,000 long tons (3,360 short tons) of monazite sand for a Government stock pile, and 1,112 short tons of this amount was imported during the year.

The wartime requirements for the rare-earth oxides contained in monazite have been stabilized, and our position in relation to stocks and supplies is favorable.

Indian monazite is better cleaned and graded than the Brazilian. Although the monazite content of the Brazilian sands is higher than that of the Indian, the thorium content is lower. The following quoted prices are nominal: $42.50 per long ton, f. o. b. India, plus $24 ocean freight to Baltimore, and $64 per metric ton, f. o. b. Brazil, plus $17 ocean freight to Baltimore.

Commercial production of cerium alloys from monazite deposits in Australia was reported for the first time in 1943.

Monazite sand and other thorium ore [1] imported for consumption in the United States, 1939–43, by countries

Country	1939		1940		1941		1942		1943	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Brazil	54	$1, 516	201	$7, 440	734	$25, 240	1, 346	$62, 555	1, 911	$88, 548
India and Dependencies	1, 336	46, 753	2, 766	92, 387	2, 714	82, 068	3, 052	112, 928	3, 033	128, 379
Netherlands Indies	170	3, 747								
United Kingdom [2]									36	3, 553
	1, 560	52, 016	2, 967	99, 827	3, 448	107, 308	4, 398	175, 483	4, 980	220, 480

[1] Quantities are gross weight; monazite content not reported.
[2] United Kingdom of Great Britain and Northern Ireland.

Many of the uses for rare earths contained in monazite that have been developed during the war will have post-war applications. It is possible, therefore, that the peacetime market, although not large, will be more stable than in pre-war years.

OLIVINE

Shipments of olivine from North Carolina in 1943 decreased to 5,415 tons valued at $48,633, as against 5,739 tons valued at $45,201 in 1942, the peak year of domestic production. The entire output in 1943 was consumed in refractories.

Experimental work on the direct reduction of olivine in an electric furnace with the addition of theoretical amounts of MgO to obtain essentially pure crystalline forsterite for use in the roofs of open-hearth furnaces was performed in the Electrotechnical Laboratory of the Bureau of Mines.[5] The addition of MgO completely eliminated the impurities and increased the high-temperature load-bearing strength of the product. The Tennessee Valley Authority developed a new use for olivine.[6] By fusing a mixture of rock phosphate and olivine in the proportions 0.46 pound olivine to 1 pound phosphate rock, a fertilizer is produced containing 22.8 percent total P_2O_5, of which 21.4 percent is citrate soluble and thus available for plant food. Prices for crude olivine f. o. b. North Carolina were quoted at $5 to $7 per short ton: ground olivine, 200-mesh, $17; and 20-mesh to dust, $12.

There is little prospect of post-war market demands for olivine exceeding those of pre-war years for its established uses, but the new uses now under investigation have additional possibilities.

PIEZOELECTRIC QUARTZ

Piezoelectric-grade quartz, a necessary component part of radio transmitting and receiving sets, detection devices, long-distance telephone transmission lines, and various precision instruments, remains near the top of the list of strategic and critical minerals. Domestic sources supplied a small tonnage for the first time since World War I, but we are still dependent almost exclusively on Brazil.

Imports of quartz for piezoelectric use in 1943 reached 1,678 short tons valued at $11,370,803, compared with 1,306 tons valued at $8,987,108 in 1942. Except for 680 pounds received from Guatemala and 585 pounds from Colombia, the entire quantity was received from Brazil. Domestic production of 2.9 tons, valued at $25,598, added to imports makes a total new supply of 1,680.9 tons. Domestic production of piezoelectric devices in 1943 amounted to 14,011,677 small oscillators, 8,474,523 large oscillators, 65,595 telephone resonators, and 24,355 units of detection equipment.

Specifications for piezoelectric quartz drawn up in 1942 by the National Bureau of Standards have changed frequently as a result of advances in technology and experience. In March 1943, specifications were revised to include fragments ranging from 100 to 200 grams in weight, 45 percent usable, and quartz containing blue needles. In January 1944, the specification for usable quartz in pieces weighing 200 grams or more was liberalized to include quartz containing moderate quantities of hard and soft blue needles, some color, fine bubbles, and inclusions; also, the 100 to 200 gram-weight material was classed as radio grade only if 80 percent appeared usable when inspected without instruments.

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[5] Ralston, R. R., McDonald, S. N., Leever, G. W., Allen, D. F., and Nichols, E. F. (in cooperation with T. V. A.), Electrically Fused Forsterite-Olivine: Jour. Am. Ceram. Soc., vol. 26, No. 12, 1943, pp. 405–408.

[6] Walthall, J. H., and Bridger, G. L., Fertilizer by Fusion of Rock Phosphate With Olivine: Ind. and Eng. Chem., ind. ed., vol. 35, No. 7, 1943, pp. 774–777.

Following are Government buying prices established August 4, 1943.

Government buying prices for piezoelectric quartz [1]

LIST 1. FACED MATERIAL

Weight class	Weight, pounds	Grade 1			Grade 2			Grade 3
		30–45 percent 13	45–60 percent 14	60–100 percent 16	30–45 percent 23	45–60 percent 24	60–100 percent 26	45–100 percent 34
2–3	0.44–0.66	$3.95	$5.95	$7.85	$3.30	$4.95	$6.60	$1.95
3–5	.66–1.1	5.30	7.90	10.55	4.40	6.60	8.80	2.65
5–7	1.1–1.5	6.60	9.90	13.20	5.50	8.25	11.00	3.30
7–10	1.5–2.2	7.90	11.90	15.85	6.60	9.90	13.20	3.95
10–20	2.2–4.4	9.90	14.85	19.80	8.25	12.35	16.50	4.95
20–30	4.4–6.6	11.90	17.85	23.75	9.90	14.85	19.80	5.95
30–40	6.6–8.8	13.20	19.80	26.40	11.00	16.50	22.00	6.60
40–50	8.8–11	14.50	21.80	29.05	12.10	18.25	24.20	7.30
50–70	11–16	15.85	23.75	31.70	13.20	19.80	26.90	7.90
70–100	16–22	17.15	25.75	34.30	14.30	21.45	28.60	8.60
100–	22–	18.50	27.70	36.95	15.40	24.00	30.80	9.20
LIST 2. UNFACED MATERIAL								
2–3	0.44–0.66	$3.16	$4.76	$6.28	$2.64	$3.96	$5.28	$1.56
3–5	.66–1.1	4.24	6.32	8.44	3.52	5.28	7.04	2.12
5–7	1.1–1.5	5.94	8.91	11.88	4.95	7.42	9.90	2.97
7–10	1.5–2.2	7.11	10.71	14.26	5.94	8.91	11.88	3.55
10–20	2.2–4.4	8.91	13.36	17.82	7.42	11.11	14.85	4.45
20–30	4.4–6.6	10.71	16.06	21.37	8.91	13.36	17.82	5.35
30–40	6.6–8.8	11.88	17.82	23.76	9.90	14.85	19.80	5.94
40–50	8.8–11	13.05	19.62	26.14	10.89	16.42	21.78	6.57
50–70	11–16	14.26	21.37	28.53	11.88	17.82	24.21	7.11
70–100	16–22	15.43	23.17	30.87	12.87	19.30	25.74	7.74
100–	22–	16.65	24.93	33.25	13.86	21.60	27.72	8.28

LIST 3. SMALL MATERIAL (MUST BE FACED) [2]

Weight class	Weight, pounds	Grade 1		Grade 2	
		45–100 percent 14L	45–100 percent 14S	45–100 percent 24L	45–100 percent 24S
1–2	0.22–0.44	$2.40	$2.00	$2.00	$1.60

[1] Purchase is made through Metals Reserve Co., a Government agency, on the basis of inspection at the Bureau of Standards. Prices given are price per pound, f. o. b. Bureau of Standards, Washington, D. C. In the symbol 13, 1 stands for grade 1, 3 stands for 30–45 percent usable. Weight class 2–3 means 200 to 300 grams, 7–10 means 700 to 1,000, and 100- means over 10,000 grams, or over 22 pounds.

[2] Small material, 100–200 grams, is separated on the basis of shape into long and short. Thus, 14L means first grade, 45–100 percent usable, and long shape.

The average number of oscillator plates obtained per pound of usable quartz increased from 9.5 in 1942 to 16.3 in 1943 as a result of an increase in cutting efficiency and a change in the design of oscillators so that smaller plates could be used. Discarded material on hand was reinspected, and 650,000 pounds of usable quartz were recovered. The War Production Board, under Conservation Order M–146 and its amendments, retains control of importation, stocks, sales, and transfers of piezoelectric quartz.

The consumption of piezoelectric quartz has expanded rapidly during the present war because of its importance in communication and detection devices. However, the same use pattern will continue in peacetime; and, with the advances made in communication technique during the war, it seems probable that post-war consumption will exceed that of the years immediately preceding the war.

SERPENTINE

Serpentine, a hydrous magnesian silicate that usually occurs as an alteration product of dunite, has again attracted attention among the industrial minerals. In 1943, the International Minerals & Chemical Co. (20 North Wacker Drive, Chicago, Ill.) used a deposit near Augusta, Ga., to make Epsom salts, and the Idaho-Maryland Mines Corporation of Grass Valley, Calif., and H. G. Wildman of Montreal, Canada, have developed processes utilizing serpentine to obtain magnesium. The Idaho-Maryland Corporation, primarily a gold-mining company, used serpentine that overlies the gold-bearing rock; and the Wildman process, which has been patented, uses serpentine from the waste piles at the asbestos mills near Thetford Mines, Quebec. These processes, however, have not progressed beyond the experimental or pilot-plant stage, and, unless they have definite cost advantages, it is unlikely that serpentine will become an important source of magnesium or magnesium compounds in the post-war markets.

STRONTIUM MINERALS

[Prepared by Charles L. Harness]

Tracer bullets and signal flares continued to provide a strong demand for domestic celestite (crude strontium sulfate) in 1943; also, low-grade celestite was used in oil-well drilling muds, substituting foı scarce barite. Shipments of celestite by producers in 1943 totaled 7,566 short tons valued at $114,526, compared with 4,041 tons valued at $55,529 in 1942. The figures include both chemical and nonchemical grades.

The principal domestic producers were the Pan-Chemical Co., 205 First National Bank Building, Pomona, Calif., deposit in the Fish Mountains of Imperial County, Calif.; the Milwhite Co., Inc., Cotton Exchange Building, Houston, Tex., deposit near Blanket, Brown County, Tex.; and Bennett-Clark Co., Inc., Box 951, Nacogdoches, Tex., deposit in Nolan County, Tex. Smaller producers and shippers were Robert I. Carr, Nashville, Ark., deposit at Dierks, Ark.; Inorganics, Inc., Knoxville, Tenn., deposit at Jamestown, Tenn.; Xact Products Co., 905 State National Bank Building, Houston, Tex., deposit at Del Rio, Tex.; and William G. Pearson, San Diego, Calif. (location of deposit not stated).

Consumption of celestite in the manufacture of strontium chemicals in 1943, was 13,387 short tons. Stocks of celestite, intended for chemical use, on December 31, 1943, were 13,732 tons, held mostly by Metals Reserve Co. Imports of celestite in 1943 were 16,881 short tons valued at $249,580, principally from Mexico, compared with 10,358 short tons valued at $144,848 in 1942.

Post-war prospects for the domestic celestite industry are negligible, because when prices drop to peacetime levels, which may approximate

$12 to $15 a short ton, c. i. f. eastern seaboard, it is unlikely that suppliers in California and Texas can compete with producers in England, Spain, and Mexico.

Prices of lump celestite remained at $30 to $35 a short ton laid down in the Philadelphia area, the same as in 1942.

TOPAZ

Production and sales of topaz in 1943 by the United Feldspar & Minerals Corporation, of Spruce Pine, N. C., from the Brewer mine near Kershaw, S. C., exceeded the 1942 figures. The topaz was used in refractories, steel mills, and in the manufacture of boro-silicate glass. In all these applications, it served chiefly as a substitute for more critical minerals, and, with the exception of the manufacture of glass, it did not progress beyond the experimental stage.

VERMICULITE

Sales of cleaned and screened vermiculite in 1943 decreased 11,203 tons (19 percent) from the all-time high of 1942, but the value increased $151,664 (47 percent).

The decline in quantity was due chiefly to a landslide at the mine at Libby, Mont., operated by the Universal Zonolite Insulation Co. (135 S. LaSalle St., Chicago, Ill.), the predominant producer, which curtailed production during the first half of the year. Other factors responsible for the decrease in production were manpower shortages at several mines and curtailed requirements for lightweight aggregate because of a reduction in building construction during the year. The average value per ton of the mine product at Libby, Mont., virtually doubled that of 1942, which accounts for the decided increase in total sales value. A review of the domestic deposits, including a description of their development, has been published recently.[7]

Production figures for domestic mines from 1939 through 1943 follow. Commercial production of vermiculite began in 1915, but the yearly output was reported as part of the mica total, or under the heading "Minerals Allied to Mica," until 1924. A table covering the period 1924–39 appeared in Minerals Yearbook, 1940.

Screened and cleaned vermiculite sold or used by producers in the United States, 1939–43

Year	Short tons	Value	Year	Short tons	Value
1939	21,174	$174,587	1942	57,848	$319,931
1940	22,299	137,698	1943	46,645	471,595
1941	23,438	125,444			

Virtually all vermiculite that enters the domestic market is cleaned and screened at the mine; some is exfoliated by the producers, or it may be sold to a processor for exfoliation. Screened vermiculite was sold to processors at $8 to $12 a short ton, f. o. b. mine. The exfoliated material was quoted at 70 cents to $1.25 a bag, each bag containing 4 cubic feet weighing 25 pounds, or $56 to $100 a short ton, f. o. b. works. Loss per ton between the raw material and the exfoliated product is about 10 percent. Assuming an average value of $75 a ton for exfoliated vermiculite, the value of sales in 1943 would be approximately $3,250,000.

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[7] Gwinn, G. Richards, Marketing Vermiculite: Bureau of Mines Inf. Circ. 7270, 1944, 15 pp.

Commercial production of vermiculite has been reported from Russia, South Africa, and Australia. Only the Russian and South African deposits are worked commercially. The Australian deposits are in process of development within the scope of the Australian market.

It seems probable that the domestic post-war market for vermiculite will be larger than in the years immediately preceding the war but somewhat below the 1942 peak.

WOLLASTONITE

A small tonnage of wollastonite, a calcium metasilicate ($Ca\ SiO_3$), was mined in 1943 from a deposit near Willsboro, Essex County, New York. It is used in the preparation of coated welding rods and in flux-shielded arc welding, the latter being a process developed by General Electric welding engineers. It also possesses satisfactory properties for use as a plastic filler, linoleum filler, ingredient for non-shrinking tile bodies, and as a scavenger in alloy-steel manufacture.[8]

The industrial uses for wollastonite are largely in the experimental stage; however, there are possible post-war markets if production costs are favorable.

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[8] Broughton, J. G., and Burnham, K. D., Occurrence and Uses of Wollastonite from Willsboro, N. Y.: Am. Inst. Min. and Met. Eng. Min. Tech. T. P. 1737, 1944, 8 pp.

EMPLOYMENT AND ACCIDENTS IN THE MINERAL INDUSTRIES

By W. W. Adams

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INTRODUCTION

The mineral industries of the United States employed fewer men in 1943 than in 1942 and thus continued the downward trend in employment that set in following 1941. A fractional decline occurred also in the number of man-hours worked, but the volume of work as thus measured remained well above the level in 1941. Iron-ore mining and the manufacture of byproduct coke appear from early reports to have increased the number of their employees. Increases in man-hours worked were indicated for coal mines, iron-ore mines, byproduct coke ovens, and smelters. Considering all mineral industries as a group, reports thus far received from operating companies show a reduction of 9 percent in number of employees and less than 1 percent in the number of man-hours worked. Of 22 groups for which separate figures were compiled, 18 had fewer employees and 15 fewer man-hours worked in 1943.

Accidents chargeable to the hazards of the work on which the employees were engaged were responsible for 1,813 deaths and 90,927 nonfatal lost-time injuries among the workers. These figures are estimated from reports from those companies that have thus far replied to Bureau of Mines inquires concerning operations during 1943. The figures reflect a fatality rate of 1.18 per million man-hours of work performed during the year, a rate more favorable than that of 1.21 for 1942, and they also indicate a nonfatal-injury rate of 59.11, which also compares favorably with the previous year's injury rate of 61.24.

The mineral industries, when considered as a group, thus had a more favorable accident record in 1943 than in 1942. Among the branches of the industries that contributed to the improvement, at least as far as nonfatal injuries are concerned (and these comprise by far the largest class of accidents), may be mentioned the anthracite mines of Pennsylvania, bituminous-coal mines in the Nation as a whole, miscellaneous-metal mines, slate quarries, and metallic-ore concentrating plants. These classes of operations must be credited with the net over-all reduction in the injury rate in 1943.

Although no data are available to account fully for the large reduction in the number of men employed in 1943, it is believed that among the principal causes of the reduction were the enlistment or draft of many men from the mining and allied industries into the armed forces of the United States and the transfer of other men to various war-supporting industries, although mining itself—especially those branches engaged in the production of minerals vitally or critically needed in the prosecution of the war—constitutes a war-supporting industry. The losses of men, however, were somewhat lessened in their damaging effect upon the prosecution of the war by the fact that the men who remained in the mines were employed at their jobs for a greater number of days during 1943 than during the previous year. The over-all average of 277 workdays per man in 1943 represented a gain of 17 workdays per man over the working time of the preceding year. Measured in hours, the gain for the average worker was about 178 hours. The gain was more than this for several branches of mining—for example, bituminous-coal mining, in which the average worker gained 23 days or 240 hours in 1943 over the period of his employment in 1942.

Number of men employed[1] in the mineral industries of the United States, 1941–43

	1941	1942	1943[2]
Coal mines:			
Bituminous[3]	457,737	448,797	[3] 409,000
Pennsylvania anthracite	88,948	82,064	76,000
	546,685	530,861	485,000
Metal mines:			
Iron	25,870	28,956	29,300
Lead-zinc (Mississippi Valley)	8,634	9,555	9,100
Copper	21,576	23,222	22,600
Gold and silver lode mines (including lead, zinc, and copper, except as listed above)	38,235	23,156	15,300
Gold placer mines	13,368	8,417	2,400
Miscellaneous (tungsten, manganese, etc.)	6,614	8,034	8,100
	114,297	101,340	86,800
Nonmetallic-mineral mines	11,088	11,233	9,900
Quarries:			
Cement	28,859	30,235	26,800
Marble	2,693	2,205	1,600
Slate	2,845	2,284	1,700
Traprock	3,029	3,114	2,600
Granite	7,830	6,307	5,300
Sandstone	3,180	2,840	2,800
Limestone	26,395	26,629	23,700
Lime	11,292	10,656	10,000
	86,123	84,270	74,500
Coke ovens:			
Byproduct	18,633	19,551	21,600
Beehive	4,008	4,358	3,900
	22,641	23,909	25,500
Metallurgical plants:			
Ore dressing	14,807	13,693	13,500
Smelters	22,003	20,636	20,400
Auxiliary works	17,539	16,825	17,000
	54,349	51,154	50,900
Grand total	835,183	802,767	732,600

[1] Figures represent summation of reports for individual mines showing daily average number of employees at each mine on days when mine was in operation.

[2] Subject to revision.

[3] The estimated average number of men "at work and exposed to mining hazards" in bituminous-coal mines was 409,000 in 1943. This figure is used throughout this chapter on employment and accidents. The estimated average number of men "on the rolls during days of operation" was slightly higher, that is, 428,000.

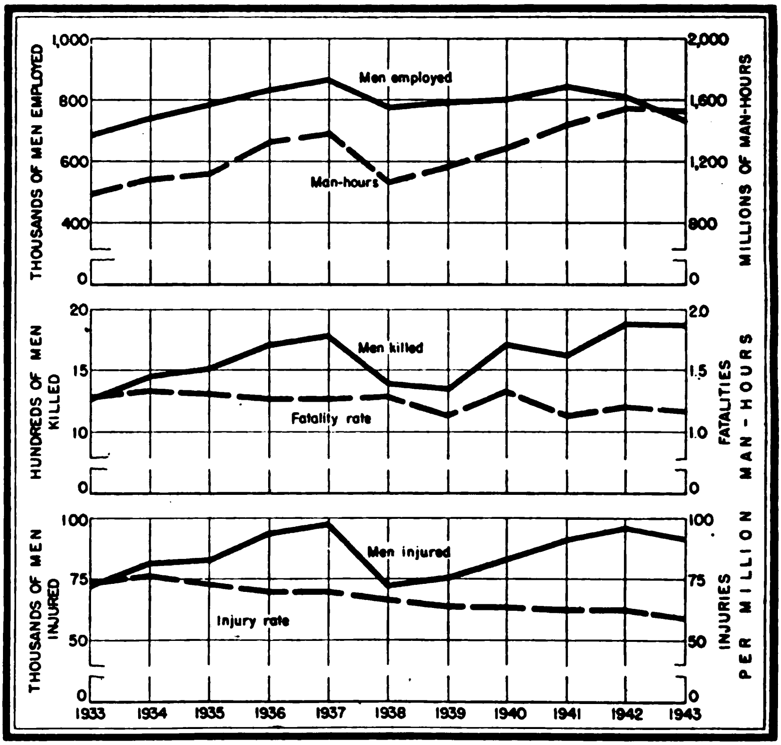

FIGURE 1.—Trend of employment and fatal and nonfatal accidents in the mineral industries of the United States, 1933–43.

Employment and accident record of mineral industries of the United States, 1933–43

Year	Men employed	Man-days of employment	Man-hours of employment	Number		Rate per million man-hours	
				Killed	Injured	Killed	Injured
1933	677,722	122,787,658	984,570,160	1,242	72,342	1.26	73.48
1934	739,817	144,566,133	1,081,694,716	1,429	81,660	1.32	75.49
1935	783,139	152,354,170	1,128,808,465	1,495	82,219	1.32	72.84
1936	824,514	177,920,334	1,326,347,029	1,686	92,643	1.27	69.85
1937	859,951	186,790,283	1,381,261,415	1,759	96,484	1.27	69.85
1938	774,894	145,056,875	1,069,729,725	1,369	71,618	1.28	66.95
1939	788,925	159,388,490	1,169,351,497	1,334	75,495	1.14	64.56
1940	801,926	175,663,792	1,293,131,693	1,716	82,861	1.33	64.08
1941	835,095	195,425,228	1,440,988,174	1,621	90,319	1.12	62.68
1942	802,767	208,781.348	1,542,962,133	1,861	94,494	1.21	61.24
1943 [1]	732,600	203,160,000	1,538,300,000	1,813	90,927	1.18	59.11

[1] Subject to revision.

EMPLOYMENT AND ACCIDENTS

BITUMINOUS-COAL MINES

Employment.—The needs of the armed forces, munitions plants, and other war-supporting industries combined to draw men away from coal mining (also a war-supporting industry) in 1943, so that a large reduction in number of employees in coal mines was revealed by reports from operating companies to the Bureau of Mines. Although reports have not been received from all companies, and will not have been received from some companies until late in 1944, available reports indicate that the number of employees engaged in mining bituminous coal dropped from 448,797 in 1942 to approximately 409,000 in 1943, a decrease of 9 percent. Production of coal is estimated at 593 million tons, an increase of about 2 percent over the output of the previous year and more than the output of any year in the entire record of mining in the United States. The mines were active about 267 days per man, as compared with 244 days in 1942. Man-hours of work during the year are estimated at nearly 789 million, to which might be added approximately 14 million man-hours to cover an estimate of the amount of "travel time" in November and December—that is, time required for the underground employees to travel from the mine entrance to their working places at the beginning of the shift and return to the mine entrance at the close of the day's work. An element of error is probably involved in the estimate of 14 million hours of "travel time" as the item was not specifically reported by the companies. Instead, some companies reported 8¼ hours, and others reported 8¾ hours as the length of shift during the last 2 months of the year; nearly all companies reported 7 hours per shift for months previous to November. From these reports, working time plus travel time is estimated at more than 802 million man-hours.

Accidents.—From reports so far received from the mining companies it is estimated that 1,248 men were killed and 53,000 men injured by accidents at the mines during 1943. The fatality rate was 1.58 per million man-hours of "working time" or 1.56 per million hours of total estimated time at the mines. As the fatality rate during the year 1942 was 1.61, the rate for 1943 reveals an improvement as far as fatal accidents are concerned. The estimated number of nonfatal injuries during 1943 reflects a rate of 67.21 per million man-hours of work and 66.06 per million man-hours if travel time is included. Either of these rates likewise reflects a fractional reduction when compared with a finally reported rate of 68.83 for 1942.

The year was marked by seven major disasters throughout the bituminous fields, in which 161 men lost their lives—148 in explosions of gas or dust and 13 in a mine fire. During 1942 there were also seven major disasters, in which 132 men lost their lives—127 from explosions of gas or dust and 5 in a surface haulage accident.

Detailed causes of the more than 54,000 fatal and nonfatal injuries during 1943 are not yet available and will not be until all reports are received from the operating companies. However, a study of coal-mine accident records over a period of recent years shows the probable cause-distribution of both fatal and nonfatal accidents that prevailed in 1943. In numerical importance, the principal causes of fatal accidents were falls of roof or face, haulage, gas or dust explosions, electricity, and machinery. The main cause of nonfatal accidents were falls of roof or face, haulage, handling materials, hand tools, and machinery. These causes covered about 87 percent of the fatalities and about 76 percent of the nonfatal injuries that were disclosed by final figures for 1942.

ANTHRACITE MINES

Employment.—This branch of the mineral industries includes operations engaged in extraction and preparation, by screening and sizing, of anthracite from virgin deposits, breaker waste, dredging culm banks, and strip-pit and underground mines. Figures are confined strictly to

Pennsylvania. During 1943 the production of anthracite is estimated at 59 million short tons, exclusive of about 1½ million tons of so-called bootleg coal, as reports of accidents or employment from mines that produce such coal are not available. The industry employed approximately 76,000 men in 1943 according to reports available at present. These men worked approximately 146 million hours in and about the mines, breakers, preparation plants, washeries, and strip pits. Seven hours was the standard shift until November, when a 7¼-hour shift was begun. The mines were operated about 272 days during the year compared with 239 days in 1942, a gain of 33 days per man.

Accidents.—Accidents during 1943 killed 228 men, 2 more than reported in 1942. The number of nonfatal injuries decreased slightly, the estimate for 1943 being 15,500 compared with 16,371 reported for the previous year. In relation to the number of man-hours of work, the record for 1943 was more favorable, as the fatality rate was 1.56 (tentative) as against 1.64 for 1942, and the rate for nonfatal injuries was 106.16 (tentative) as against 119.01 per million hours worked.

The anthracite mines of Pennsylvania have to their credit an outstanding safety record regarding freedom from major disasters, that is, disasters in which five or more lives are lost. Reports show that no major disaster of any kind occurred during the period from June 3 1938, to September 23, 1943, a period of 5 years, 3 months, and 20 days'

IRON-ORE MINES

Employment.—Reports so far received indicate a continued increase in number of men employed and volume of work performed at iron-ore mines in 1943. Tentative figures reveal an employment of approximately 29,300 men compared with 28,956 in 1942. Man-hours of work performed likewise increased to more than 67.8 million, a gain of about 1 percent over the previous year. The number of workdays per employee increased only slightly in 1943.

Accidents.—According to present information, there were fewer fatalities but more nonfatal injuries in 1943 than in 1942. About 45 men were killed last year compared with 56 in 1942. Reports for 1943 also indicated that 1,620 men sustained injuries which caused them to lose time from their work. The combined accident-frequency rate in 1943 was about 24.56 per million man-hours, which was only a fraction higher than the rate of 24.41 for 1942. These rates include a fatality rate of 0.66 in 1943 and 0.84 in 1942.

COPPER MINES

Employment.—Employment at copper mines in 1943, although higher than that for 1941, dropped below the 1942 figure. According to available reports, the number of mine workers was approximately 22,600, a decrease of 3 percent below 1942, although an increase of 5 percent over 1941. Man-hours worked at the mines fell to 58.7 million from 60.4 million in 1942, but were more than the 55.1 million worked in 1941.

Accidents.—Present estimates of accidents show an increase in 1943. The number of deaths was 73 and the number of injuries 3,200. An explosion of dust and sulfur fumes at the Boyd mine of the Tennessee Copper Co., which caused the death of 9 men, was partly responsible for the increase in fatalities. These figures represent a fatality rate of 1.24 and an injury rate of 54.51 per million man-hours worked compared with a fatality rate of 0.83 and an injury rate of 49.43 for 1942.

LEAD-ZINC MINES (MISSISSIPPI VALLEY STATES)

Classification.—Included in this group are mines that produce lead and zinc in the Mississippi Valley States, principally Oklahoma, Missouri, and Kansas, known as the Tri-State area; also included are fluorspar mines in Kentucky and Illinois, as similar accident conditions prevail in the two classes of mines in the States named. This procedure not only permits the publication of separate figures for Kentucky and Illinois but also maintains unbroken a statistical series in Bureau of Mines accident records that extends back to 1911.

Employment.—The number of men employed and the number of man-hours of work performed in 1943 declined in comparison with 1942 but remained at a higher level than in 1941. Incomplete returns indicate a total of more than 9,100 employees, a decrease of 5 percent from 1942. The total volume of employment measured in man-hours decreased from 21.1 million in 1942 to 19.6 million in 1943, a loss of 7 percent.

Accidents.—Tentative figures based upon reports now available indicate an accident-frequency rate in 1943 of 57.24 deaths and injuries per million man-hours of work performed, a slight increase over the rate of 54.15 for 1942. Accidents during 1943 included 22 deaths and 1,100 injuries. Eight men were killed by a cave-in at Shullsburg, Wis., on February 9, 1943.

GOLD AND SILVER MINES (LODE AND PLACER)

Classification.—This group includes not only mines that were operated chiefly for the gold or silver content of their ores but also lead and zinc mines located outside of the Mississippi Valley States and mines that produced some copper but that were operated chiefly because the ore contained metal other than copper.

Employment.—Employment at both lode and placer mines showed a continued sharp decline in 1943 from 1942. The war program resulted in an order by the War Production Board in 1942 that excluded gold and silver mines from the priority benefits of Preference Rating Order P–56; the higher scale of wages paid by defense industries caused a general exodus from gold and silver mines; and the needs of the armed forces likewise contributed to the manpower shortage. These and other economic factors accounted for the sharp decline in the number of men employed and the volume of labor performed in 1943. The group as a whole, upon a basis of preliminary returns, employed about 17,700 men in 1943; 15,300 represented the number of workers at lode mines and 2,400 those at placer operations. Lode mines in 1942 employed 23,156 men and placer mines had 8,417 workers. Man-hours of employment in 1943 totaled 29.7 million at lode mines and 3.5 million at placers. There was therefore a decline of about 44 percent in the total number of men employed and about 45 percent in the total volume of labor performed.

Accidents.—As estimated for 1943, the accident-frequency rate was less favorable than that revealed by final figures for 1942 for both lode and placer mines. The tentative rate for 1943, covering fatal and nonfatal accidents, was 104.37 per million man-hours worked compared with a final rate of 91.90 for 1942; the rate for placer mines was 40.00 compared with 36.92 in 1942; the rate for lode mines was 111.95 in 1943 and 105.75 in 1942. It is estimated that 25 men were killed and 3,440 injured by accidents in 1943.

MISCELLANEOUS METAL MINES

Classification.—Included in this group are all mines engaged in the production of metallic ores, exclusive of gold, silver, copper, lead, zinc, and iron; these mines yield such strategic and critical war minerals as bauxite, manganese, chromite, tungsten, mercury, and molybdenum, as well as various other minerals.

Employment.—Company reports to the Bureau of Mines now on hand show that this group as a whole employed about 8,100 men in 1943 compared with 8,034 in 1942. Man-hours of employment decreased from 17.9 million in 1942 to 17.2 million in 1943.

Accidents.—The safety record of the miscellaneous metal-mine group as estimated for 1943, was more favorable than in 1942. The accident-frequency rate per million man-hours of employment decreased from 88.34 in 1942 to approximately 65.23 in 1943, the lowest rate since 1938. Accidents during 1943 caused 22 deaths and 1,100 nonfatal lost-time injuries among the workers, according to reports thus far furnished to the Bureau of Mines by the operators of the mines.

NONMETALLIC-MINERAL MINES

Classification.—This group includes mines that yield any kind of nonmetallic mineral except coal, stone sand, gravel, and clay; therefore, it includes mines that produce phosphate rock, gypsum, magnesite, barite, sulfur, feldspar, rock salt, mica, and many other minerals.

Employment.—Preliminary reports reveal that over 9,900 men were employed in 1943, a decrease of 12 percent from the 11,233 men employed in 1942. Man-hours of employment amounted to approximately 23.4 million, a loss of 6 percent from 1942.

Accidents.—Although final figures are not available present reports for 1943 indicate that 15 men were killed and 1,200 were injured by accidents during the year. The accident-frequency rate per million man-hours was 51.92 in 1943 compared with the slightly lower rate of 51.88 for 1942.

CEMENT MILLS AND QUARRIES

Employment.—Approximately 26,800 men were employed in the cement industry (quarries and mills) in 1943, a decrease of 11 percent from 1942, when a total of 30,235 men was employed. These men worked an estimated 61.7 million man-hours, a decrease of 13 percent from the number of hours worked during the preceding year. The volume of work reported for 1943 indicated an average of 299 days per employee, a loss of 15 days per employee from the record of 1942.

Accidents.—Despite decreased employment the number of accidents increased. The number is estimated at 830 for nonfatal injuries and 23 for fatalities compared with a final count of 787 injuries and 46 fatalities in 1942. The tentative fatality rate was 0.37 and the nonfatal-injury rate 13.45 per million man-hours of employment compared with final rates of 0.65 and 11.07 in 1942.

MARBLE QUARRIES

Employment.—The decline in employment at marble quarries in 1942, as reported a year ago, continued through 1943. Approximately 1,600 men were employed and 3.6 million man-hours were worked, a decrease of 27 percent in the number of employees and 19 percent in the number of man-hours of exposure to occupational risk. The number of man-days of work performed during 1943 represented an average of 269 workdays per man; an increase of 22 days over 1942.

Accidents.—No man lost his life by an accident at a marble quarry in 1943. Nonfatal injuries numbered 210 and resulted in a rate of 58.33 injuries per million man-hours. This rate compares unfavorably with the nonfatal-injury rate of 38.55 in 1942. However, the fatality-free record of 1943 compares favorably with the fatal-accident record of 1942, as accidents during the latter year resulted in the death of two men.

SLATE QUARRIES

Employment.—It is estimated that 1,700 men were employed in slate quarries in 1943, a decrease of 26 percent from the number employed in 1942. Man-hours of employment totaled 3.5 million, a decrease of 22 percent. An average of 246 workdays per employee indicated an increase of 15 days per employee over the previous year.

Accidents.—Preliminary reports indicate that no fatal accident occurred in the slate industry in 1943 and that 175 men were injured by nonfatal accidents. Based upon these estimates the nonfatal-injury rate was 50.00 per million man-hours compared with a fatality rate of 0.45 and an injury rate of 74.44 in 1942, thus showing a material improvement in 1943.

TRAPROCK QUARRIES

Employment.—Reports indicate that 2,600 men worked 4.6 million man-hours in1943. This was a decrease in both the number of men working and the number of man-hours when compared with 1942. The number of employees was less by 17 percent than the number working in 1942, and the number of man-hours decreased 18 percent. Average working time was 208 days per employee, a loss of 4 days per employee.

Accidents.—Four men were killed and 280 suffered nonfatal injuries during the course of their employment in 1943. As a result, the fatality rate was 0.87 and the nonfatal-injury rate was 60.87, both being close to the rates shown by final reports for 1942, which revealed a fatality rate of 0.89 and an injury rate of 59.43.

GRANITE QUARRIES

Employment.—According to present reports, granite quarries employed 5,300 men in 1943, a decrease of 16 percent from 1942. The volume of employment was 1.3 million man-shifts or 11.0 million man-hours, the latter figure a decline of 12 percent compared with 1942.

Accidents.—Eight men were killed in 1943 compared with 14 in 1942. Nonfatal accidents decreased with man-hours of employment, but not in the same proportion. The number of nonfatal injuries is estimated at 480 compared with 531 in 1942. Accidents in 1943 resulted in a fatality rate tentatively placed at 0.73 and in a nonfatal-injury rate of 43.64. Similar rates for 1942 were 1.12 and 42.39, respectively.

SANDSTONE QUARRIES

Employment.—The number of men employed at sandstone quarries in 1943 maintained approximately the same level as that shown by final figures for 1942. A total of 2,,800 men worked 5.4 million man-hours during 1943; each employee averaged 231 days of work.

Accidents.—Estimates indicate that there were five fatalities in 1943 compared with one in 1942. Nonfatal lost-time injuries during 1943 resulted in disability to 348 employees. These accidents disclosed a fatality rate of 0.93 and a nonfatal-injury rate of 64.44, both rates being higher than those of 0.19 and 59.49, respectively, in 1942.

LIMESTONE QUARRIES

Employment.—Available reports indicate that 23,700 men were employed in the limestone-quarrying industry in 1943, a decline of 11 percent from 1942. The man-hours of employment decreased 6 percent, from 51.7 million in 1942 to 48.7 million in 1943. These figures do not cover limestone that was produced chiefly for the manufacture of cement or lime.

Accidents.—Accidents in and about the quarries and plants killed 31 men and injured 2,350. These accidents revealed a fatality rate of 0.64 and a nonfatal-injury rate of 48.25 compared with 0.58 and 48.98, respectively, in 1942.

LIMEKILNS AND ASSOCIATED QUARRIES

Employment.—Approximately 10,000 men were employed in 1943, a decrease of 6 percent from the number employed in 1942. Despite this decrease, the number of man-hours of employment was only slightly (2 percent) below the 1942 figure. Man-hours worked in 1943 are estimated at 25.2 million. The industry averaged 314 days of work per employee, indicating a gain of 8 days per man.

Accidents.—Fatal and nonfatal accidents increased in number in 1943. Incomplete reports indicate that 16 men were killed and 1,400 injured compared with 12 killed and 1,342 injured in 1942. The 1943 fatality rate was 0.63 and the nonfatal-injury rate 55.56 compared with 0.47 and 52.35, respectively, in 1942.

BYPRODUCT COKE OVENS

Employment.—Byproduct coking was one of the few branches of the mineral industries that reported increased employment in 1943. According to final and complete reports, the industry had 21,632 workers, an increase of more than 10 percent over 1942. Man-hours totaled 62.7 million, an increase of more than 10 percent. The operating time of the ovens was 363 days, indicating that nearly all active plants were operating full time throughout the year.

Accidents.—Fifteen men were killed by accidents, a record that compares unfavorably with that of 1942 when only 9 fatal accidents were reported. The number of nonfatal injuries increased from 545 in 1942 to 611 in 1943, causing the injury rate to rise from 9.60 in 1942 to 9.75 in 1943. The fatality rate for 1943 was 0.24 compared with 0.16 in 1942.

BEEHIVE COKE OVENS

Employment.—A decline in employment was reported for beehive coke ovens in 1943. Final figures are expected to show that 3,900 men worked during the year and performed 7.6 million man-hours of labor, a decrease of 11 percent in the number of employees and 10 percent in the number of man-hours worked. The operating time of the ovens averaged 274 days per employee, substantially the same as in 1942 when the average was 275 days.

Accidents.—Three men were killed and 340 men met with nonfatal lost-time injuries, according to present estimates. Thus the estimated fatality rate was 0.39 and the nonfatal-injury rate 44.74. These rates compare with the fatality rate of 0.47 and a nonfatal-injury rate of 44.49 in 1942.

ORE-DRESSING PLANTS

Classification.—The term "ore-dressing plant" or "mill" includes concentrators, stamp mills, sampling works, and slime plants; lixiviation, leaching, cyanide, flotation and tailing mills; crushing and screening plants; and sintering plants, calciners, washers, and driers. The men in this group were therefore engaged in the direct milling of copper, gold and silver, iron, lead, zinc, and miscellaneous metal ores.

Employment.—Ore-dressing and beneficiating plants or mills employed approximately 13,500 men in 1943, a small decrease from 1942. The plants as a group were in operation about 32.6 million man-hours, a decline compared with the 33.4 million worked in 1942.

Accidents.—Accidents to men employed at the mills killed 14 and injured 830 in 1943. These accidents resulted in a rate of 25.89 per million man-hours. The corresponding rate for 1942 was 27.24 per million man-hours and that for 1941 was 28.41, showing progress in accident prevention during the past 2 years.

SMELTERS

Employment.—The smelting industry, as used here, covers the smelting and refining of all primary metallic ores except iron ore. Employment and accident statistics covering iron-ore smelting and steel manufacturing are collected and compiled by the United States Department of Labor and hence are not included in Bureau of Mines figures. Reports for the smelting industry, as thus defined, show that 20,400 men were employed in 1943. This figure represents a small loss compared with the 20,636 men employed in 1942. The man-hours worked during 1943 totaled 56.9 million, a slight increase over the 56.6 million worked during 1942. The period of operation of the smelters, considering all as a single group, averaged 343 workdays per employee. This was 6 days less per man than in 1942. Although smelting is normally a full-time operation, the figures show that some plants were not active for a full year.

Accidents.—Accidents to men employed at smelters during 1943 killed 11 men and caused lost-time injuries to 1,770. The fatality rate was 0.19, and the injury rate was 31.11 per million man-hours of work done. Each of these figures represents an increase over the corresponding rate of the previous year, when the fatality rate was 0.12 and the injury rate 30.52.

AUXILIARY WORKS AT ORE-DRESSING PLANTS AND SMELTERS

Employment.—The term "auxiliary works" covers all operations at mills and smelters not directly connected with milling and smelting processes, such as machine, blacksmith and carpenter shops, yards, general construction, etc. About 17,000 men were employed in 1943, representing little change from the 16,825 men employed in 1942. The man-hours worked during 1943 showed an increase to 46.7 million compared with the figure of 45 million in 1942.

Accidents.—Men employed in auxiliary works suffered 5 fatal accidents and 1,174 nonfatal lost-time injuries in 1943. These accidents indicate an accident-frequency rate of 25.25 per million man-hours, an increase over the rate of 23.52 for 1942.

SUMMARY, 1933–43

Continuance of the decline in the number of employees in the mineral industries of the United States brought the number of workers not only below the level of 1942 but also lower than any other year except 1933, the low point of the past 11 years. A quite different situation, however, obtains regarding the number of man-hours of work performed during the 11-year period. In fact, the volume of work done, as measured by man-hours worked, was greater during 1943 than during any other year except 1942. It is possible that final reports, when received from all companies, may carry the total man-hours for 1943 slightly above the number reported for 1942, as the present estimate for 1943, based upon incomplete reports, is within 1 percent of the final figure for the previous year.

A few highlights of the 11-year record of the mineral industries of the United States may be recited to compare the record of 1943, as estimated from incomplete reports, with previous high points or low points of the period covered. The number of workers in 1943 was, as previously stated, smaller than in any other year except 1933, when the number was 678,000; the highest point was reached in 1937, when the number reached almost 860,000. Man-hours worked during 1943, only a fraction of 1 percent under the preceding year, topped all other years under discussion and were 56 percent more than the 985,000,000 hours worked in 1933. Man-days worked during 1943 exceeded 203 million, which was about 3 percent less than in 1942 but 65 percent more than the number worked during 1933, the low-point year. Fatalities from accidents during 1943 reached an estimated total of 1,813 and exceeded by 46 percent the number reported for 1933, which was 1,242; nevertheless, the fatality rate in 1943, which was 1.18 per million man-hours of employment, was more favorable than the rate of 1.26 for 1933 because of the greater proportionate increase in man-hours worked than in the number of fatal accidents. The 1943 rate, however, was not as favorable as that (1.12) for 1941, the year for which the lowest rate was reported. Nonfatal lost-time injuries, estimated at 90,927 from reports for 1943, were 27 percent above the 71,618 injuries that occurred in 1938 (the year of fewest injuries) and 26 percent above the 72,342 injuries reported for 1933 (the year ranking next to 1938 in the small number of injuries reported). However, the injury rate of 59.11 per million man-hours of employment for 1943 was more favorable than corresponding rates of 66.95 for 1938 and 73.48 for 1933, and the rate for 1943 was also more favorable than that of any other year of the period 1933–43.

Only an estimate can be made of the number of days lost as a result of accidents in the mineral industries during 1943, not only because many companies have not furnished their reports to the Bureau of Mines but primarily because the reports from the operators do not state the number of days lost from accidents at each mine. The number of fatalities and the number of nonfatal injuries are known, or rather these two facts will be known when all companies shall have reported; meanwhile, they can be estimated from reports already received. With this information, the lost time from both classes of accidents may be estimated. As each fatality is chargeable for statistical purposes with 6,000 lost days, the loss of 1,813 lives from accidents in the mineral industries during the past year may be said to represent the loss of 10,878,000 days. When final reports have been received covering nonfatal injuries (the number of which is at present estimated at 90,927) it will be found that some of the injuries caused the total, lifelong disability of the injured employees, other injuries will be found to have caused permanent but only partial disability, and still others will be found to have resulted in temporary disability. Permanent total disabilities, like fatalities, are chargeable with 6,000 days each; permanent partial disabilities vary in their time-loss charges according to the part of the body impaired and the degree of impairment; temporary disabilities are charged with the actual number of calendar days during which the injured employee, because of his injury, was unable to work. When all three classes of nonfatal injuries are combined, 85 days probably would represent a fair average of days lost per injury. Applying this average to the estimated 90,927 nonfatal injuries during 1943, the time lost as a result of the injuries was approximately 7,730,000 man-days. Thus the fatal injuries and the nonfatal injuries during 1943 represent a combined period of about 18,600,000 man-days. This disability chargeable to accidents was approximately 9 percent of the 203 million man-days worked by all employees in the mineral industries during 1943. In other words, as far as the time element is concerned, accidents were responsible for a 9-percent loss to the mineral industries during 1943.

This loss of manpower from industrial accidents during a global war is, to a great extent, an unnecessary addition to the unavoidable loss of life and limb in the military phases of the war. Military losses will stop when the war is won, but the losses from industrial accidents will continue during the post-war period. That accidents in the industry will continue to occur after military victory is achieved is a certainty. That the number of accidents in industry may be reduced is also a certainty; the only uncertain factor is the extent to which they may be reduced. The solution of the problem does not lie in the lap of the gods but rather in the lap of industry. Leaders of industry, or, more strictly speaking, a larger number of them, are the individuals on whose interest in accident prevention depends the saving of life and limb of miners and other industrial workers during the post-war years.

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